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CALIFORNIA BUILDING STANDARDS COMMISSION

CALIFORNIA 2025 BUILDING CODE

CALIFORNIA CODE OF REGULATIONS | TITLE 24 PART 2
VOLUME 2 OF 2

BASED ON THE 2024 INTERNATIONAL BUILDING CODE®

INTERNATIONAL CODE COUNCIL®

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CALIFORNIA BUILDING STANDARDS COMMISSION

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CALIFORNIA BUILDING CODE 2025

CALIFORNIA CODE OF REGULATIONS ▯ TITLE 24 PART 2

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Effective January 1, 2026

For Errata and Supplement effective dates see the History Note Appendix

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PREFACE

This document is Part 2 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24,* also referred to as the *California Building Standards Code.* This part is known as the *California Building Code.*

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936

Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov

Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2025 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of the State Architect, Office of the State Fire Marshal, Department of Health Care Access and Information, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections, Department of Water Resources, State Historical Building Safety Board, Department of Consumer Affairs, State Librarian, Department of Food and Agriculture, and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

Members of the California Building Standards Commission

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Kevin Day – Deputy Executive Director

For questions on California state agency amendments, please refer to the contact list on page v.

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CALIFORNIA CODE OF REGULATIONS, TITLE 24

California State Agency Contact List

The following state agencies may propose building standards for buildings, structures and applications under their authority for publication in Title 24. Notice of such proposals may be requested from each agency. See Sections 1.2 through 1.14 of the California Building Code (Part 2, T24) for detailed information on the regulatory authority of most state agencies summarized below. Note [agency acronyms] shown in banners/Matrix Adoption Tables in T24.

Board of State and Community Corrections [BSCC]
bscc.ca.gov — BSCC-Mail@bscc.ca.gov
(916) 445-5073 — *Local Detention Facilities*

Building Standards Commission [BSC, BSC-CG]
dgs.ca.gov/BSC — cbsc@dgs.ca.gov
(916) 263-0916 — *State Buildings including UC & CSU Nonresidential Green Building Standards*

Department of Consumer Affairs Boards/Bureaus:

Acupuncture Board [CA]
acupuncture.ca.gov — AcuPolicy@dca.ca.gov
(916) 515-5200 — *Acupuncture Offices*

Board of Pharmacy [CA]
pharmacy.ca.gov
(916) 518-3100 — *Pharmacies*

Board of Barbering and Cosmetology [CA]
barbercosmo.ca.gov — barbercosmo@dca.ca.gov
(916) 574-7570 — *Barber, Cosmetology & Electrolysis Establishments*

Bureau of Household Goods and Services [CA]
bhgs.dca.ca.gov
(916) 999-2041 — *Insulation Testing*

Structural Pest Control Board [CA]
pestboard.ca.gov — pestboard@dca.ca.gov
(800) 737-8188 — *Structural Pest Control Locations*

Veterinary Medical Board [CA]
vmb.ca.gov — vmb@dca.ca.gov
(916) 515-5220 — *Veterinary Facilities*

Department of Food and Agriculture [AGR]
cdfa.ca.gov
(916) 900-5004 — *Rendering & Collection Centers*
(916) 900-5064 — *Meat & Poultry Packing Plants*
(916) 900-5008 — *Milk & Dairy Food Safety*

Department of Health Care Access and Information
Office of Statewide Hospital Planning and Development
[OSHPD 1, 1R, 2, 3, 4, 5, 6]
hcai.ca.gov — regsunit@hcai.ca.gov
(916) 440-8300 — *Hospital Standards, Skilled Nursing Facility Standards & Clinic Standards*

Department of Public Health [DPH]
cdph.ca.gov (Recreational Health)
(916) 449-5661 — *Food Establishments, Organized Camps, Public Swimming Pools*

Department of Housing and Community Development
[HCD 1, 2, 1-AC]
hcd.ca.gov — Title24@hcd.ca.gov
(800) 952-8356
Option 5 > Option 2 — *State Housing Law: including Housing Accessibility, Hotels/Motels, Apartments/Condominiums, Dormitories, Single-Family Dwellings, ADUs, Permanent Structures in Mobile Home Parks*
Option 5 > Option 4 — *Factory-Built Housing*
Option 5 > Option 5 — *Employee Housing*

Department of Water Resources [DWR]
water.ca.gov — DWRwebcomment@water.ca.gov
(916) 653-5791 — *Plumbing for Recycled Water, Floodplain Construction*

Division of the State Architect
dgs.ca.gov/DSA
(916) 445-8100

Access Compliance [DSA-AC]
(916) 445-5827 — DSAaccess@dgs.ca.gov
Access for Persons with Disabilities

Structural Safety [DSA-SS, DSA-SS/CC]
Public Schools & Community Colleges, State Essential Services Buildings

State Historical Building Safety Board [SHBSB]
(916) 445-7627 — shbsb@dgs.ca.gov
Historical Building Rehabilitation, Preservation, Restoration or Relocation

Energy Commission [CEC]
energy.ca.gov — Title24@energy.ca.gov
(800) 772-3300 — *Building Energy Efficiency, Compliance Manual & Compliance Forms*

Office of the State Fire Marshal [SFM]
osfm.fire.ca.gov — codedevelopment@fire.ca.gov
(916) 568-3800 — *Fire & Life Safety*

State Lands Commission [SLC]
slc.ca.gov — MOTEMS.Public@slc.ca.gov
(510) 741-4950 — *Marine Oil Terminals*

State Librarian [SL]
library.ca.gov — csllaw@library.ca.gov
(916) 323-9843 — *Public Library Construction & Renovation*

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How to Distinguish Between Model Code Language and California Amendments

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italics.

***[BSC]** This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption, and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.*

Legend of Acronyms of Adopting State Agencies

BSC	*California Building Standards Commission (see Section 1.2)*
BSC-CG	*California Building Standards Commission-CALGreen (see Section 1.2.2)*
BSCC	*Board of State and Community Corrections (see Section 1.3)*
SFM	*Office of the State Fire Marshal (see Section 1.11)*
HCD 1	*Department of Housing and Community Development (see Section 1.8.2.1.1)*
HCD 2	*Department of Housing and Community Development (see Section 1.8.2.1.3)*
HCD 1/AC	*Department of Housing and Community Development (see Section 1.8.2.1.2)*
DSA-AC	*Division of the State Architect-Access Compliance (see Section 1.9.1)*
DSA-SS	*Division of the State Architect-Structural Safety (see Section 1.9.2)*
DSA-SS/CC	*Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)*
OSHPD 1	*Office of Statewide Hospital Planning and Development (see Section 1.10.1)*
OSHPD 1R	*Office of Statewide Hospital Planning and Development (see Section 1.10.1)*
OSHPD 2	*Office of Statewide Hospital Planning and Development (see Section 1.10.2)*
OSHPD 3	*Office of Statewide Hospital Planning and Development (see Section 1.10.3)*
OSHPD 4	*Office of Statewide Hospital Planning and Development (see Section 1.10.4)*
OSHPD 5	*Office of Statewide Hospital Planning and Development (see Section 1.10.5)*
OSHPD 6	*Office of Statewide Hospital Planning and Development (see Section 1.10.6)*
DPH	*Department of Public Health (see Section 1.7)*
AGR	*Department of Food and Agriculture (see Section 1.6)*
CEC	*California Energy Commission (see Section 100 in Part 6, the California Energy Code)*
CA	*Department of Consumer Affairs (see Section 1.4):* *Board of Barbering and Cosmetology* *Board of Examiners in Veterinary Medicine* *Board of Pharmacy* *Acupuncture Board* *Bureau of Household Goods & Services* *Structural Pest Control Board (SPCB)*
SL	*State Library (see Section 1.12)*
SLC	*State Lands Commission (see Section 1.14)*
DWR	*Department of Water Resources (see Section 1.13 of Chapter 1 of the California Plumbing Code in Part 5 of Title 24)*

The state agencies are available to answer questions about their adoptions. Contact information is provided on page v of this code.

To learn more about the use of this code, refer to pages vii through ix. Training materials on the application and use of this code are available at the website of the California Building Standards Commission www.dgs.ca.gov/bsc.

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California Matrix Adoption Tables

Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are nonregulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency's statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies' adoption as follows:

Adopt the entire IBC chapter without state amendments.

If there is an "X" under a particular state agency's acronym on this row, this means that particular state agency has adopted the entire model code chapter without any state amendments.

Example:

CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS
(Matrix Adoption Tables are nonregulatory, intended only as an aid to the user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter			X																					
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below								S	A	M	P	L	E											
Chapter/Section																								

Adopt the entire IBC chapter as amended, state-amended sections are listed below:

If there is an "X" under a particular state agency's acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each section that a state agency has amended and/or added within a particular chapter is listed. There will be an "X" under an agency's acronym in the row of the amended and/or added section.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)			X																					
Adopt only those sections that are listed below								S	A	M	P	L	E											
Chapter/Section																								
202			X																					

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Adopt only those sections that are listed below:

If there is an "X" under a particular state agency's acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an "X" in the column under the agency's acronym, as well as an "X" by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below					**X**	**X**		S	A	M	P	L	E											
Chapter/Section																								
202					X	X																		
203					X	X																		

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MARGINAL MARKINGS

Symbols in the margin indicate the status of code changes as follows:

‖ This symbol indicates that a change has been made to a California amendment.

> This symbol indicates deletion of California amendment language.

| This symbol indicates that a change has been made to International Code Council model language.

➡ This symbol indicates deletion of International Code Council model language.

A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code.

RELOCATION OF TEXT OR TABLES

The following table indicates relocation of sections and tables in the 2024 edition of the IBC from the 2021 edition.

RELOCATIONS	
2024 LOCATION	**2021 LOCATION**
104.2.3	104.11
104.2.3.5	104.11.2
104.2.3.6	104.11.1
104.2.4	104.10
104.2.4.1	104.10.1
104.4	104.6
705.1	705.9
705.11	705.1
1110.6	E105.2
1110.6.1	E105.2.1
1110.6.2	E105.2.2
1110.15	1110.12.2
1110.15.1	1110.12.2.1
1112.6	E107.2
1402.3.1	1403.14
1403.9	1403.10
1404.5	1404.17
1404.5.1	2603.11
1404.5.2	2603.12
1404.5.2.1	2603.12.1
Table 1404.5.2.1	Table 2603.12.1
1404.5.2.2	2603.12.2
Table 1404.5.2.2	Table 2603.12.2
1404.5.3	2603.13
1404.5.3.1	2603.13.1
Table 1404.5.3.1	Table 2603.13.1
1404.5.3.2	2603.13.2
Table 1404.5.3.2	Table 2603.13.2
1607.22	1607.14.3
1607.22.1	1607.14.3.1
1607.22.2	1607.14.3.2
1607.22.3	1607.14.3.3
1607.22.4	1607.14.3.4
1607.22.5	1607.14.3.5
1607.10	1607.17
1607.11	1607.10
1607.17	1607.18
1607.19	1607.20

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RELOCATIONS—continued	
2024 LOCATION	**2021 LOCATION**
1607.20	1607.21
1607.21	1607.22
1613.3	1613.2.5.2
2214	2208
2308.7	2308.3
2308.8	2308.4
2308.9	2308.5
2308.10	2308.6
2308.11	2308.7
3301.3	3301.2.1
3301.4	3302.1

ABOUT THE I-CODES

The 2024 I-Codes, published by the ICC, are 15 fully compatible titles intended to establish provisions that adequately protect public health, safety and welfare; that do not unnecessarily increase construction costs; that do not restrict the use of new materials, products or methods of construction; and that do not give preferential treatment to particular types or classes of materials, products or methods of construction.

The I-Codes are updated on a 3-year cycle to allow for new construction methods and technologies to be incorporated into the codes. Alternative materials, designs and methods not specifically addressed in the I-Code can be approved by the building official where the proposed materials, designs or methods comply with the intent of the provisions of the code.

The I-Codes are used as the basis of laws and regulations in communities across the US and in other countries. They are also used in a variety of nonregulatory settings, including:

- Voluntary compliance programs.
- The insurance industry.
- Certification and credentialing for building design, construction and safety professionals.
- Certification of building and construction-related products.
- Facilities management.
- “Best practices” benchmarks for designers and builders.
- College, university and professional school textbooks and curricula.
- Reference works related to building design and construction.

Code Development Process

The code development process regularly provides an international forum for building professionals to discuss requirements for building design, construction methods, safety, performance, technological advances and new products. Proposed changes to the I-Codes, submitted by code enforcement officials, industry representatives, design professionals and other interested parties are deliberated through an open code development process in which all interested and affected parties may participate.

Openness, transparency, balance, due process and consensus are the guiding principles of both the ICC Code Development Process and OMB Circular A-119, which governs the federal government’s use of private-sector standards. The ICC process is open to anyone without cost. Remote participation is available through cdpAccess®, the ICC’s cloud-based app.

In order to ensure that organizations with a direct and material interest in the codes have a voice in the process, the ICC has developed partnerships with key industry segments that support the ICC’s important public safety mission. Some code development committee members were nominated by the following industry partners and approved by the ICC Board:

- American Gas Association (AGA)
- American Institute of Architects (AIA)
- American Society of Plumbing Engineers (ASPE)
- International Association of Fire Chiefs (IAFC)
- National Association of Home Builders (NAHB)
- National Association of State Fire Marshals (NASFM)
- National Council of Structural Engineers Association (NCSEA)
- National Multifamily Housing Council (NMHC)
- Plumbing Heating and Cooling Contractors (PHCC)
- Pool and Hot Tub Alliance (PHTA), formerly The Association of Pool and Spa Professionals (APSP)

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Code development committees evaluate and make recommendations regarding proposed changes to the codes. Their recommendations are then subject to public comment and council-wide votes. The ICC's governmental members—public safety officials who have no financial or business interest in the outcome—cast the final votes on proposed changes.

The I-Codes are subject to change through future code development cycles and by any governmental entity that enacts the code into law. For more information regarding the code development process, contact the Codes and Standards Development Department of the ICC at iccsafe.org/products-and-services/i-codes/code-development/.

While the I-Code development procedure is thorough and comprehensive, the ICC, its members and those participating in the development of the codes expressly disclaim any liability resulting from the publication or use of the I-Codes, or from compliance or noncompliance with their provisions. NO WARRANTY OF ANY KIND, IMPLIED, EXPRESSED OR STATUTORY, IS GIVEN WITH RESPECT TO THE I-CODES. The ICC does not have the power or authority to police or enforce compliance with the contents of the I-Codes.

Code Development Committee Responsibilities (Letter Designations in Front of Section Numbers)

In each cycle, proposed changes are considered by the Code Development Committee assigned to a specific code or subject matter. Committee Action Hearings result in recommendations regarding a proposal to the voting membership. Where changes to a code section are not considered by that code's own committee, the code section is preceded by a bracketed letter designation identifying a different committee. Bracketed letter designations for the I-Code committees are:

[A] = Administrative Code Development Committee
[BE] = IBC—Egress Code Development Committee
[BF] = IBC—Fire Safety Code Development Committee
[BG] = IBC—General Code Development Committee
[BS] = IBC—Structural Code Development Committee
[E] = Developed under the ICC's Standard Development Process
[EB] = International Existing Building Code Development Committee
[F] = International Fire Code Development Committee
[FG] = International Fuel Gas Code Development Committee
[M] = International Mechanical Code Development Committee
[P] = International Plumbing Code Development Committee
[SP] = International Swimming Pool and Spa Code Development Committee

For the development of the 2027 edition of the I-Codes, the ICC Board of Directors approved a standing motion from the Board Committee on the Long-Term Code Development Process to revise the code development cycle to incorporate two committee action hearings for each code group. This change expands the current process from two independent 1-year cycles to a single continuous 3-year cycle. There will be two groups of code development committees and they will meet in separate years. The current groups will be reworked. With the energy provisions of the *International Energy Conservation Code*® (IECC®) and Chapter 11 of the *International Residential Code*® (IRC®) now moved to the Code Council's Standards Development Process, the reduced volume of code changes will be distributed between Groups A and B.

Code change proposals submitted for code sections that have a letter designation in front of them will be heard by the respective committee responsible for such code sections. Because different committees hold Committee Action Hearings in different years, proposals for most codes will be heard by committees in both the 2024 (Group A) and the 2025 (Group B) code development cycles. It is very important that anyone submitting code change proposals understands which code development committee is responsible for the section of the code that is the subject of the code change proposal.

Please visit the ICC website at iccsafe.org/products-and-services/i-codes/code-development/current-code-development-cycle for further information on the Code Development Committee responsibilities as it becomes available.

Coordination of the I-Codes

The coordination of technical provisions allows the I-Codes to be used as a complete set of complementary documents. Individual codes can also be used in subsets or as stand-alone documents. Some technical provisions that are relevant to more than one subject area are duplicated in multiple model codes.

INTRODUCTION TO THE INTERNATIONAL BUILDING CODE

The *International Building Code* establishes minimum requirements for building systems using prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new building designs.

The IBC is a model code that provides minimum requirements to safeguard the public health, safety and general welfare of the occupants of new and existing buildings and structures. It addresses structural strength, means of egress, sanitation, adequate lighting and ventilation, accessibility, energy conservation and life safety in regard to new and existing buildings, facilities and systems.

The IBC applies to all occupancies, including one- and two-family dwellings and townhouses that are not within the scope of the *IRC*. The *IRC* is referenced for coverage of detached one- and two-family dwellings and townhouses as defined in the exception to Section 101.2 and the definition for "*Townhouse*" in Chapter 2. The *IRC* can also be used for the construction of live/work units (as

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defined in Section 508.5) and small bed and breakfast-style hotels where there are five or fewer guestrooms and the hotel is owner-occupied. The IBC applies to all types of buildings and structures unless exempted. Work exempted from permits is listed in Section 105.2.

ARRANGEMENT AND FORMAT OF THE 2025 CBC

The format of the CBC allows each chapter to be devoted to a particular subject. The following table shows how the CBC is divided. The subsequent tables show CBC requirements that are correlated with other Codes. The chapter synopses detail the scope and intent of the provisions of the CBC.

CHAPTER TOPICS	
CHAPTERS	**SUBJECTS**
1, 2	Administration and Definitions
3	Use and Occupancy Classifications
4, 31, *31A–31F*	Special Requirements for Specific Occupancies or Elements
5–6	Height and Area Limitations Based on Type of Construction
7–9	Fire Resistance and Protection Requirements
10	Requirements for Evacuation
11A, 11B	Specific Requirements to Allow Use and Access to a Building for Persons with Disabilities
12, 27, *28,* 30	Building Systems, Such as Lighting, HVAC, Elevators
13	*This chapter is not adopted in California. Refer to California Energy Code, Title 24, Part 6.*
14–26	Structural Components—Performance and Stability
32	Encroachment Outside of Property Lines
33	Safeguards during Construction
35	Referenced Standards
Appendices A–*Q*	Appendices

INTERNATIONAL FIRE CODE CORRELATED TOPICS

The IBC requirements for hazardous materials, fire-resistance-rated construction, interior finish, fire protection systems, means of egress, emergency and standby power, and temporary structures are directly correlated with the requirements of the *International Fire Code*® (IFC®). The following table shows chapters/sections of the IBC that are correlated with the IFC:

IBC/IFC CORRELATED TOPICS		
IBC CHAPTER/SECTION	**IFC CHAPTER/SECTION**	**SUBJECT**
Sections 307, 414, 415	Chapters 50–67	Hazardous materials and Group H requirements
Chapter 7	Chapter 7	Fire-resistance-rated construction (fire and smoke protection features in the IFC)
Chapter 8	Chapter 8	Interior finish, decorative materials and furnishings
Chapter 9	Chapter 9	Fire protection systems
Chapter 10	Chapter 10	Means of egress
Chapter 27	Section 604	Standby and emergency power
Section 3103	Chapter 31	Temporary structures

Chapter 1 Scope and Administration.

Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. The provisions of Chapter 1 establish the authority and duties of the code official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.

Chapter 2 Definitions.

Chapter 2 is the repository of the definitions of terms used in the body of the code. The user of the code should be familiar with and consult this chapter because the definitions are essential to the correct interpretation of the code and because the user may not be aware that a term is defined.

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Chapter 3 Occupancy Classification and Use.

Chapter 3 provides for the classification of buildings, structures and parts thereof based on the purpose for which they are used. Section 302 identifies the groups into which all buildings, structures and parts thereof must be classified. Sections 303 through 312 identify the occupancy characteristics of each group classification. In some sections, specific group classifications having requirements in common are collectively organized such that one term applies to all. For example, Groups A-1, A-2, A-3, A-4 and A-5 are individual groups for assembly-type buildings. The general term “Group A,” however, includes each of these individual groups. Other groups include Business (B), *Organized Camps (C),* Educational (E), Factory (F-1, F-2), High Hazard (H-1, H-2, H-3, H-4, H-5), Institutional (I-2, I-3, I-4), *Laboratories (L),* Mercantile (M), Residential (R-1, R-2, *R-2.1, R-2.2,* R-3, *R-3.1,* R-4), Storage (S-1, S-2) and Utility (U). In some occupancies, the smaller number means a higher hazard, but that is not always the case.

Defining the use of the buildings is very important as it sets the tone for the remaining chapters of the code. Occupancy works with the height, area and construction type requirements in Chapters 5 and 6, to determine "equivalent risk." The determination of equivalent risk involves three interdependent considerations: (1) the level of fire hazard associated with the specific occupancy of the facility; (2) the reduction of fire hazard based on the fuel load by limiting the floor area and the height of the building; and (3) the level of overall fire resistance provided by the type of construction. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type.

Occupancy classification also plays a key part in the appropriate protection measures. As such, threshold requirements for fire protection and means of egress systems are based on occupancy classification (see Chapters 9 and 10). Other sections of the code also contain requirements respective to the classification of building groups. For example, Section 706 specifies requirements for fire wall fire-resistance ratings that are tied to the occupancy classification of a building and Section 803.11 contains interior finish requirements that are dependent upon the occupancy classification. The use of the space, rather than the occupancy of the building, is utilized for determining occupant loading (Section 1004) and live loading (Section 1607).

Chapter 4 Special Detailed Requirements Based on Occupancy and Use.

Chapter 4 contains the requirements for protecting special uses and occupancies which are supplemental to the remainder of the code. For example, the height and area limitations established in Chapter 5 apply to all special occupancies unless Chapter 4 contains height and area limitations. In this case, the limitations in Chapter 4 supersede those in other sections. An example of this is the height and area limitations for open parking garages given in Section 406.5.4, which supersede the limitations given in Sections 504 and 506.

In some instances, it may not be necessary to apply the provisions of Chapter 4. For example, if a covered mall building complies with the provisions of the code for Group M, Section 402 does not apply; however, other sections that address a use, process or operation must be applied to that specific occupancy, such as stages and platforms, special amusement buildings and hazardous materials (Sections 410, 411 and 414).

The chapter includes requirements for buildings and conditions that apply to one or more groups, such as high-rise buildings, underground buildings or atriums. Special uses may also imply specific occupancies and operations, such as for Group H, hazardous materials, and uses with associated combustibility hazards, which are coordinated with the CFC. Unique consideration is taken for special use areas, such as covered mall buildings, motor-vehicle-related occupancies, special amusement buildings and aircraft-related occupancies. Special facilities within other occupancies are considered, such as stages and platforms, motion picture projection rooms, children’s play structures and storm shelters. Finally, in order that the overall package of protection features can be easily understood, unique considerations for specific occupancies are *also* addressed.

Chapter 5 General Building Heights and Areas.

Chapter 5 contains the provisions that regulate the minimum type of construction for area limits and height limits based on the occupancy of the building. Height and area increases are permitted based on open frontage for fire department access, separation and the type of sprinkler protection provided (Sections 503 through 506, 510). Provisions include the protection and/or separation of incidental uses (Table 509.1), accessory occupancies (Section 508.2) and mixed uses in the same building (Sections 506.2.2, 508.3, 508.4 and 510). Unlimited area buildings are permitted in certain occupancies when they meet special provisions (Section 507). Live/work units are provided for in Section 508.5.

Tables 504.3, 504.4 and 506.2 are the keystones in setting thresholds for building size based on the building’s use and the materials with which it is constructed. Respective to each group classification, the greater the fire-resistance rating of structural elements, as represented by the type of construction, the greater the floor area and height allowances. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type.

Chapter 6 Types of Construction.

The interdependence of fire safety considerations can be seen by looking at Tables 601 and 705.5, which show the fire-resistance ratings of the principal structural elements comprising a building in relation to the five classifications for types of construction. Type I construction generally requires the highest fire-resistance ratings for structural elements, whereas Type V construction generally requires the least amount of fire-resistance-rated structural elements. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type. Section 603 includes a list of combustible elements that can be part of a noncombustible building (Types I and II construction).

Chapter 7 Fire and Smoke Protection Features.

Chapter 7 provisions present the fundamental concepts of fire performance that all buildings are expected to achieve in some form. This chapter identifies the acceptable materials, techniques and methods by which proposed construction can be designed and evaluated against to determine a building's ability to limit the impact of fire.

Chapter 7A Materials and Construction Methods for Exterior Wildfire Exposure.

Requirements for Wildland-Urban Interface Areas are now located in Part 7 of Title 24, California Wildland-Urban Interface Code. The provisions of Part 7, California Wildland-Urban Interface Code, shall apply to buildings and structures located in the wildland-urban interface (WUI) or Fire Hazard Severity Zone.

Chapter 8 Interior Finishes.

Chapter 8 contains the performance requirements for controlling fire growth within buildings by restricting interior finish and decorative materials. The provisions of Chapter 8 require materials used as interior finishes and decorations to meet certain flame-spread index or flame-propagation criteria based on the relative fire hazard associated with the occupancy.

Chapter 9 Fire Protection and Life Safety Systems.

Chapter 9 prescribes the minimum requirements for active systems of fire protection equipment to perform the following functions: detect a fire, alert the occupants or fire department of a fire emergency, and control smoke and control or extinguish the fire. Generally, the requirements are based on the occupancy, the height and the area of the building, because these are the factors that most affect firefighting capabilities and the relative hazard of a specific building or portion thereof. This chapter parallels and is substantially duplicated in Chapter 9 of the CFC; however, the CFC Chapter 9 also contains periodic testing criteria that are not contained in the CBC. In addition, the special fire protection system requirements based on use and occupancy found in CBC Chapter 4 are duplicated in CFC Chapter 9 as a user convenience.

Chapter 10 Means of Egress.

The criteria in Chapter 10 regulating the design of the means of egress system are established as the primary method for protection of occupants by allowing timely relocation or evacuation. Both prescriptive and performance language is utilized for determination of a safe exiting system. It addresses all portions of the means of egress system (i.e., exit access, exits and exit discharge) and includes design requirements as well as provisions regulating individual components. The requirements detail the size, arrangement, number and protection of means of egress components. The means of egress protection requirements work in coordination with other sections of the code, such as protection of vertical openings (see Chapter 7), interior finish (see Chapter 8), fire suppression and detection systems (see Chapter 9) and numerous others, all having an impact on life safety. Chapter 10 of the CBC is duplicated in Chapter 10 of the CFC; however, the CFC contains one additional section on the maintenance of the means of egress system in existing buildings.

Chapter 11 ***Reserved.***

Chapter 11A Housing Accessibility.
Chapter 11B Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

Verify compliance with accessibility provisions. In order to be considered as accessible, buildings and their individual elements must comply with the applicable scoping and technical provisions of Chapter 11A and/or Chapter 11B.

Chapter 12 Interior Environment.

Chapter 12 provides minimum standards for the interior environment of a building. The standards address the minimum sizes of spaces, as well as minimums for temperature, light and ventilation. Concerns for sound transmission and acoustics are addressed. Finally, the chapter provides minimum standards for toilet and bathroom construction.

Chapter 13 Energy Efficiency.

Chapter 13 is not adopted in California. Refer to California Energy Code, Title 24, Part 6.

Chapter 14 Exterior Walls.

Chapter 14 addresses requirements for exterior walls of buildings. Minimum standards for wall covering materials, installation of wall coverings and the ability of the wall to provide weather protection are provided.

Chapter 15 Roof Assemblies and Rooftop Structures.

Chapter 15 provides standards for both roof assemblies and structures that sit on top of the roofs of buildings. The criteria address roof construction and covering, including the weather-protective barrier at the roof and, in most circumstances, a fire-resistant barrier.

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Chapter 16 Structural Design.

Chapter 16 prescribes minimum structural loading requirements for use in the design and construction of buildings and structural components. The chapter references and relies on many nationally recognized design standards, including the American Society of Civil Engineers' *Minimum Design Loads for Buildings and Other Structures* (ASCE 7).

Chapter 16A Structural Design.

Chapter 16A prescribes minimum structural loading requirements for use in the design and construction of structures regulated by the Division of the State Architect—Structural Safety, which include public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Section 1.9.2.1 (DSA-SS)), and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development, which include hospitals and correctional treatment centers (applications listed in Sections 1.10.1 (OSHPD 1) and 1.10.4 (OSHPD 4)).

Chapter 17 Special Inspections and Tests.

Chapter 17 provides a variety of procedures and criteria for testing materials and assemblies, labeling materials and assemblies and special inspection of structural assemblies. This chapter expands on the inspections of Chapter 1 by requiring special inspection where indicated and, in some cases, structural observation.

Chapter 17A Special Inspections and Tests.

Chapter 17A provides a variety of procedures and criteria for testing materials and assemblies, labeling materials and assemblies, and special inspection of structural assemblies. Chapter 17A is applicable to structures regulated by the Division of the State Architect—Structural Safety, which include public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Sections 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC)), and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development, which include hospitals and correctional treatment centers (applications listed in Sections 1.10.1 (OSHPD 1) and 1.10.4 (OSHPD 4)).

Chapter 18 Soils and Foundations.

Chapter 18 provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads from the structure above.

Chapter 18A Soils and Foundations.

Chapter 18A provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads from the structure above. Chapter 18A is applicable to structures regulated by the Division of the State Architect—Structural Safety, which include public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Sections 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC)), and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development, which include hospitals and correctional treatment centers (applications listed in Sections 1.10.1 (OSHPD 1) and 1.10.4 (OSHPD 4)).

Chapter 19 Concrete.

Chapter 19 provides minimum accepted practices for the design and construction of buildings and structural components using concrete, both plain and reinforced. This chapter relies primarily on the reference to American Concrete Institute (ACI) 318, *Building Code Requirements for Structural Concrete*.

Chapter 19A Concrete.

Chapter 19A provides minimum accepted practices for the design and construction of buildings and structural components using concrete, both plain and reinforced. Chapter 19A is applicable to structures regulated by the Division of the State Architect—Structural Safety, which include public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Section 1.9.2.1 (DSA-SS)), and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development, which include hospitals and correctional treatment centers (applications listed in Sections 1.10.1 (OSHPD 1) and 1.10.4 (OSHPD 4)).

Chapter 20 Aluminum.

Chapter 20 contains standards for the use of aluminum in building construction. This chapter references national standards from the Aluminum Association (AA) for use of aluminum in building construction, AA ASM 35, *Aluminum Sheet Metal Work in Building Construction*, and AA ADM, *Aluminum Design Manual*.

Chapter 21 Masonry.

Chapter 21 provides comprehensive and practical requirements for masonry construction.

Chapter 21A Masonry.

Chapter 21A provides comprehensive and practical requirements for masonry construction. Chapter 21A is applicable to structures regulated by the Division of the State Architect—Structural Safety, which include public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Section 1.9.2.1 (DSA-SS)), and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development, which include hospitals and correctional treatment centers (applications listed in Sections 1.10.1 (OSHPD 1) and 1.10.4 (OSHPD 4)).

Chapter 22 Steel.

Chapter 22 provides the requirements necessary for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures and steel storage racks. Chapter 22 requires that the design and use of steel materials be in accordance with the specifications and standards of the American Institute of Steel Construction, the American Iron and Steel Institute, the Steel Joist Institute and the American Society of Civil Engineers.

Chapter 22A Steel.

Chapter 22A provides the requirements necessary for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures and steel storage racks. Chapter 22A is applicable to structures regulated by the Division of the State Architect—Structural Safety, which include public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Section 1.9.2.1 (DSA-SS)), and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development, which include hospitals and correctional treatment centers (applications listed in Sections 1.10.1 (OSHPD 1) and 1.10.4 (OSHPD 4)).

Chapter 23 Wood.

Chapter 23 provides minimum requirements for the design of buildings and structures that use wood and wood-based products.

Chapter 24 Glass and Glazing.

Chapter 24 establishes regulations for glass and glazing that, when installed in buildings and structures, are subjected to wind, snow and dead loads.

Chapter 25 Gypsum Board, Gypsum Panel Products and Plaster.

Chapter 25 contains the provisions and referenced standards that regulate the design, construction and quality of gypsum board, gypsum panel products and plaster and reinforced gypsum concrete.

Chapter 26 Plastic.

Chapter 26 addresses the use of plastics in building construction and components. This chapter provides standards addressing foam plastic insulation, foam plastics used as interior finish and trim, and other plastic veneers used on the inside or outside of a building.

Chapter 27 Electrical.

Since electrical systems and components are an integral part of almost all structures, Chapter 27 references the *California Electrical Code (CEC).* In addition, Section 2702 addresses emergency and standby power requirements and references where they are required. Such systems must comply with the CFC and referenced standards.

Chapter 28 Mechanical Systems.

Nearly all buildings will include mechanical systems. Chapter 28 provides references to the *CMC and other codes* for the design and installation of mechanical systems. In addition, Chapter 21 of this code is referenced for masonry chimneys, fireplaces and barbecues.

Chapter 29 *Reserved*.

Chapter 30 Elevators and Conveying Systems.

Chapter 30 provides standards for the installation of elevators into buildings, including requirements for elevator shafts and lobbies. Referenced standards provide the requirements for the elevator system and mechanisms. Special provisions are indicated for fire service access elevators and for the optional choice of occupant evacuation elevators in high rise buildings (see Section 403).

Chapter 31 Special Construction.

Chapter 31 contains a collection of regulations for a variety of unique structures and architectural features. Pedestrian walkways and tunnels connecting two buildings are addressed in Section 3104. Safeguards for swimming pool safety are addressed in Section 3109. Standards for temporary structures, including permit requirements, are provided in Section 3103. Structures as varied as awnings, marquees, signs, telecommunication and broadcast towers and automatic vehicular gates are also addressed (see Sections 3105

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through 3108 and 3110). Unique types of buildings, such as membrane structures, greenhouses, relocatable buildings and intermodal shipping containers (Sections 3102, 3112, 3113 and 3114) are also addressed in this chapter.

Chapter 31A Systems for Window Cleaning or Exterior Building Maintenance.

See Title 8, California Code of Regulations, Division 1, Chapter 4, Subchapter 7, General Industry Safety Orders, Group 1, Articles 5 and 6.

Chapter 31B Public Pools.

Chapter 31B is promulgated by the California Department of Public Health and provides the requirements for the construction, installation, renovation, alteration, addition, relocation, replacement, or use of any public pool and to its ancillary facilities, mechanical equipment and related piping. Public pools include those located in or designated as the following: commercial building, hotel, motel, resort, recreational vehicle or mobile home park, campground, apartment house, condominium, townhouse, homeowner association, club, community building or area, public or private school, health club or establishment, water park, swim school, medical facility, bed and breakfast, licensed day-care facility, recreation and park district, and municipal pools.

Chapter 31C Radiation.

Chapter 31C is promulgated by the California Department of Public Health and focuses on radiation safety standards for buildings and equipment.

Chapter 31D Food Establishments.

Chapter 31D is promulgated by the California Department of Public Health. The provisions of this chapter apply to the construction of commissaries serving mobile food preparation units.

Chapter 31E Reserved.

Chapter 31F Marine Oil Terminals.

Chapter 31F is promulgated by the California State Lands Commission (SLC) and establishes minimum engineering, inspection and maintenance criteria for marine oil terminals (MOTs) in order to prevent oil spills and to protect public health, safety and the environment. The provisions of this chapter regulate onshore and offshore MOTs, including marine terminals that transfer liquefied natural gas (LNG) and are applicable to the evaluation of existing MOTs and design of new MOTs in California. The Marine Environmental Protection Division administers this chapter on behalf of the SLC.

Chapter 32 Encroachments into the Public Right-of-Way.

Buildings and structures may be designed to extend over a property line and into the public right-of-way. Local regulations outside of the building code usually set limits to such encroachments, and such regulations take precedence over the provisions of this chapter. Chapter 32 establishes parameters for such encroachments, not only at grade but also above and below grade. Pedestrian walkways must also comply with Chapter 31.

Chapter 33 Safeguards During Construction.

Chapter 33 provides safety requirements for the job site during construction and demolition of buildings and structures. In addition, it provides requirements intended to protect the public from injury and adjoining property from damage.

Chapter 34 Reserved.

Chapter 35 Referenced Standards.

Chapter 35 lists all of the product and installation standards and codes that are referenced throughout Chapters 1 through 33 and includes identification of the promulgators and the section numbers in which the standards and codes are referenced. As stated in Section 102.4, these standards and codes become an enforceable part of the code (to the prescribed extent of the reference) as if printed in the body of the code.

Appendix A Employee Qualifications.

Effective administration and enforcement of the family of International Codes depends on the training and expertise of the personnel employed by the jurisdiction and their knowledge of the codes. Section 103 of the code establishes the Department of Building Safety and calls for the appointment of a building official and deputies, such as plans examiners and inspectors. Appendix A provides standards for experience, training and certification for the building official and the other staff mentioned in Chapter 1.

Appendix B Board of Appeals.

Appendix B contains the provisions for appeal and the establishment of a board of appeals. The provisions include the application for an appeal, the makeup of the board of appeals and the conduct of the appeal process.

Appendix C Group U—Agricultural Buildings.

Appendix C provides special consideration for the construction of agricultural buildings reflective of their specific usage and limited occupant load. The provisions of this appendix allow reasonable heights and areas commensurate with the risk of agricultural buildings.

Appendix D Fire Districts.

Appendix D establishes a framework by which a jurisdiction can establish a portion of a jurisdiction as a fire district where limiting the potential spread of fire is a key consideration. Fire district standards restrict certain occupancies within the district, as well as setting higher minimum construction standards.

Appendix E *Reserved.*

Appendix F Rodentproofing.

The provisions of Appendix F are minimum mechanical methods to prevent the entry of rodents into a building.

Appendix G Flood-Resistant Construction.

Appendix G is intended to fulfill the flood-plain management and administrative requirements of the National Flood Insurance Program (NFIP) that are not included in the code. Communities that adopt the IBC and Appendix G will meet the minimum requirements of NFIP as set forth in Title 44 of the Code of Federal Regulations.

Appendix H Signs.

Appendix H gathers in one place the various code standards that regulate the construction and protection of outdoor signs.

Appendix I Patio Covers.

Appendix I provides standards applicable to the construction and use of patio covers. It is limited in application to patio covers accessory to dwelling units. Covers of patios and other outdoor areas associated with restaurants, mercantile buildings, offices, nursing homes or other nondwelling occupancies would be subject to standards in the main code and not this appendix.

Appendix J Grading.

Appendix J provides standards for the grading of properties. This appendix also provides standards for administration and enforcement of a grading program including permit and inspection requirements.

Appendix K *Group R-3 and Group R-3.1 Occupancies Protected by the Facilities of the Central Valley Flood Protection Plan.*

Appendix K provides provisions applicable to new construction, changes of use and to substantial improvement and restoration of substantial damage as defined in Section 1612 of Groups R-3 and R-3.1 located in areas protected by the facilities of the Central Valley Flood Protection Plan.

Appendix L Earthquake Recording Instrumentation.

The purpose of Appendix L is to foster the collection of ground motion data, particularly from strong-motion earthquakes. When this ground motion data is synthesized, it may be useful in developing future improvements to the earthquake provisions of the CBC.

Appendix M Tsunami-Generated Flood Hazards.

Addressing a tsunami risk for all types of construction in a tsunami hazard zone through building code requirements would typically not be cost effective, making tsunami-resistant construction impractical at an individual building level. However, Appendix M does allow the adoption and enforcement of requirements for tsunami hazard zones that regulate the presence of high-risk or high-hazard structures.

Appendix N Replicable Buildings.

Appendix N provides jurisdictions with a means of incorporating replicable building requirements contained in the ICC G1-2010, *Guideline for Replicable Buildings*, into their building code adoption process. The intent is to streamline the plan review process at the local level by removing redundant reviews.

Appendix O Performance-Based Application.

Appendix O provides an optional design, review and approval framework for use by the building official. It extracts relevant administrative provisions from the *International Code Council Performance Code® for Buildings and Facilities* (ICCPC®) into a more concise, usable appendix format for a jurisdiction confronted with such a need.

Appendix P Sleeping Lofts.

Appendix P provides allowances for, and limitations on, spaces intended to be used as sleeping lofts, while differentiating these spaces from mezzanines and other habitable spaces.

Appendix Q Emergency Housing.

This appendix shall be applicable to emergency housing and emergency housing facilities. Emergency sleeping cabins, emergency transportable housing units, membrane structures and tents constructed and assembled in accordance with this appendix shall be occupied only during declaration of state of emergency, local emergency or shelter crises. Buildings and structures constructed in accordance with the California Building Code, used as emergency housing, shall be permitted to be permanently occupied.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 16 – STRUCTURAL DESIGN

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter				X	X								X			X								
Adopt entire chapter as amended (amended sections listed below)	X								X		X	X			X									
Adopt only those sections that are listed below						X	X																X	
Chapter / Section																								
1601.1.1									X		X	X			X									
1601.1.2									X		X	X			X									
1601.1.3									X		X	X			X									
1601.1.4									X															
1601.1.5									X		X	X			X									
1601.2									X		X	X			X									
1603.1											X	X			X									
Table 1604.5												X			X									
1605.2											X	X			X									
Table 1607.1											X	X			X									
1607.9						X																		
1607.9.2						X	X																	
1607.12.4	X																							
1607.22.5											X	X			X									
1612.3.2											X	X			X									
1613.1											X	X			X									
1613.1.1																							X	
1613.1.2	X																							
1613.1.3	X																							
1613.2											X	X			X									
1613.4											X	X			X									
1613.7											X	X			X									
1617									X															

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

16 STRUCTURAL DESIGN

User notes:

About this chapter: Chapter 16 establishes minimum design requirements so that the structural components of buildings are proportioned to resist the loads that are likely to be encountered. In addition, this chapter assigns buildings and structures to risk categories that are indicative of their intended use. The loads specified herein along with the required load combinations have been established through research and service performance of buildings and structures. The application of these loads and adherence to the serviceability criteria enhance the protection of life and property.

ICC code development note: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 1601—GENERAL

1601.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof.

1601.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 16 is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.*
2. *Hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD) as listed in Sections 1.10.1, 1.10.2 and 1.10.5.*

1601.1.2 Amendments in this chapter. [DSA-SS/CC] *DSA-SS/CC adopts this chapter as amended.* ***[OSHPD]*** *OSHPD adopts this chapter as amended.*

1601.1.3 Identification of amendments. [DSA-SS/CC] [OSHPD 1R, 2 & 5]

1. *Division of the State Architect - Structural Safety/Community Colleges amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS/CC] *- For applications listed in Section 1.9.2.2.*
2. ***[OSHPD 1R, 2 & 5]*** *Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 5] *- For applications listed in Section 1.10.5.*

1601.1.4 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

1601.1.5 Additional amendments. [DSA-SS/CC, OSHPD]

1. ***[OSHPD 1R, 2 & 5]*** *In addition to the amendments in this chapter, these buildings shall comply with the requirements of Sections 1617A.1.1, 1617A.1.4, 1617A.1.11, 1617A.1.13, 1617A.1.18, 1617A.1.27, 1617A.1.39 and 1617A.1.41.*
2. ***[DSA-SS/CC]*** *See Section 1617 for additional requirements.*

1601.2 Enforcement agency approval. [DSA-SS/CC, OSHPD 1R, 2 & 5] *In addition to requirements of the California Administrative Code and the California Building Code, any aspect of project design, construction, quality assurance or quality control programs for which this code requires approval by the Registered Design Professional (RDP), are also subject to approval by the enforcement agency.*

SECTION 1602—NOTATIONS

1602.1 Notations. The following notations are used in this chapter:

D = Dead load.
D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.
E = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4 of ASCE 7.
F = Load due to fluids with well-defined pressures and maximum heights.
F_a = Flood load in accordance with Chapter 5 of ASCE 7.
H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.
L = Live load.
L_r = Roof live load.
$p_{g(asd)}$ = Allowable stress design ground snow load.
p_g = Ground snow load determined from Figures 1608.2(1) through 1608.2(4) and Table 1608.2.

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R = Rain load.

S = Snow load.

T = Cumulative effects of self-straining load forces and effects.

V_{asd} = Allowable stress design wind speed, mph (m/s) where applicable.

V = Basic wind speed, V, mph (m/s) determined from Figures 1609.3(1) through 1609.3(4) or ASCE 7.

V_T = Tornado speed, mph (m/s) determined from Chapter 32 of ASCE 7.

W = Load due to wind pressure.

W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

SECTION 1603—CONSTRUCTION DOCUMENTS

1603.1 General. Construction documents shall show the material, size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the construction documents.

Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof dead and live loads.
2. Ground snow load, p_g, and allowable stress design ground snow load, $p_{g(asd)}$.
3. Basic wind speed, V, mph (m/s), and allowable stress design wind speed, V_{asd}, as determined in accordance with Section 1609.3.1 and wind exposure.
4. Seismic design category and site class.
5. Flood design data, if located in flood hazard areas established in Section 1612.3.
6. Design load-bearing values of soils.
7. Rain load data.

[OSHPD 1R, 2 & 5] *Additional requirements are included in Sections 7-115 and 7-125 of the California Administrative Code (Part 1, Title 24, C.C.R).*

1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.13 shall be indicated for each type of live load used in the design.

1603.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas.

1603.1.3 Roof snow load data. The ground snow load, p_g, shall be indicated. In areas where the ground snow load, p_g, exceeds 15 pounds per square foot (psf) (0.72 kN/m^2), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load, p_f.
2. Snow exposure factor, C_e.
3. Risk category.
4. Thermal factor, C_t.
5. Slope factor(s), C_s.
6. Drift surcharge load(s), p_d, where the sum of p_d and p_f exceeds 30 psf (1.44 kN/m^2).
7. Width of snow drift(s), w.
8. Winter wind parameter for snow drift, W_2.

1603.1.4 Wind and tornado design data. The following information related to wind loads and, where required by Section 1609.5, tornado loads shall be shown, regardless of whether wind or tornado loads govern the design of the lateral force-resisting system of the structure:

1. Basic wind speed, V, mph (m/s), tornado speed, V_T, mph (m/s), and allowable stress design wind speed, V_{asd}, mph (m/s), as determined in accordance with Section 1609.3.1.
2. Risk category.
3. Effective plan area, A_e, for tornado design in accordance with Chapter 32 of ASCE 7.
4. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
5. Applicable internal pressure coefficients, and applicable tornado internal pressure coefficients.
6. Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the registered design professional responsible for the design of the structure, pounds per square foot (kN/m^2). Where design for tornado loads is required, the design pressures shown shall be the maximum of wind or tornado pressures.

1603.1.5 Earthquake design data. The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

1. Risk category.

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2. Seismic importance factor, I_e.
3. Spectral response acceleration parameters, S_S and S_1.
4. Site class.
5. Design spectral response acceleration parameters, S_{DS} and S_{D1}.
6. Seismic design category.
7. Basic seismic force-resisting system(s).
8. Design base shear(s).
9. Seismic response coefficient(s), C_s.
10. Response modification coefficient(s), R.
11. Analysis procedure used.

1603.1.6 Geotechnical information. The design load-bearing values of soils shall be shown on the construction documents.

1603.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.4, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. Flood design class assigned according to ASCE 24.
2. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation of the proposed lowest floor, including the basement.
3. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation to which any nonresidential building will be dry floodproofed.
4. In coastal high hazard areas and coastal A zones, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1603.1.8 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof, including but not limited to the loads of machinery or equipment, and that are greater than specified floor and roof loads shall be specified by their descriptions and locations.

1603.1.8.1 Photovoltaic panel systems. The dead load of rooftop-mounted photovoltaic panel systems, including rack support systems, shall be indicated on the construction documents.

1603.1.9 Roof rain load data. Design rainfall intensity, i (in/hr) (cm/hr), and roof drain, scupper and overflow locations shall be shown regardless of whether rain loads govern the design.

SECTION 1604—GENERAL DESIGN REQUIREMENTS

1604.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters and referenced standards.

1604.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604.3.

TABLE 1604.3—DEFLECTION LIMITS[a, b, c, h, i]

CONSTRUCTION	L or L_r	S^{j} or W^{f}	$D + L^{d, g}$
Roof members:[e]			
Supporting plaster or stucco ceiling	$l/360$	$l/360$	$l/240$
Supporting nonplaster ceiling	$l/240$	$l/240$	$l/180$
Not supporting ceiling	$l/180$	$l/180$	$l/120$
Floor members	$l/360$	—	$l/240$
Exterior walls:			
With plaster or stucco finishes	—	$l/360$	—
With other brittle finishes	—	$l/240$	—
With flexible finishes	—	$l/120$	—
Interior partitions:[b]			
With plaster or stucco finishes	$l/360$	—	—
With other brittle finishes	$l/240$	—	—

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TABLE 1604.3—DEFLECTION LIMITS[a, b, c, h, i]—continued			
CONSTRUCTION	L or L_r	S^j or W^f	$D + L^{d, g}$
With flexible finishes	$l/120$	—	—
Farm buildings	—	—	$l/180$
Greenhouses	—	—	$l/120$

For SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed $l/60$. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed $l/150$. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed $l/90$. For roofs, this exception only applies when the metal sheets have no roof covering.

b. Flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.16.

c. See Section 2403 for glass supports.

d. The deflection limit for the $D + (L$ or $L_r)$ load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For lumber, structural glued laminated timber, prefabricated wood I-joists and structural composite lumber members that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from $0.5D$. For lumber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from D. The value of $0.5D$ shall not be used in combination with ANSI/AWC NDS provisions for long-term loading.

e. The preceding deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 8 of ASCE 7.

f. The wind load shall be permitted to be taken as 0.42 times the "component and cladding" loads or directly calculated using the 10-year mean return interval basic wind speed, V, for the purpose of determining deflection limits in Table 1604.3. Where framing members support glass, the deflection limit therein shall not exceed that specified in Section 1604.3.7

g. For steel structural members, the deflection due to creep component of long-term dead load shall be permitted to be taken as zero.

h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed $l/60$. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed $l/175$ for each glass lite or $l/60$ for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed $l/120$.

i. l = Length of the member between supports. For cantilever members, l shall be taken as twice the length of the cantilever.

j. The snow load shall be permitted to be taken as 0.7 times the design snow load determined in accordance with Section 1608.1 for the purpose of determining deflection limits in Table 1604.3.

1604.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

1604.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI 100 or SJI 200, as applicable.

1604.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by TMS 402.

1604.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM.

1604.3.6 Limits. The deflection limits of Section 1604.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

1604.3.7 Framing supporting glass. The deflection of framing members supporting glass subjected to 0.6 times the "component and cladding" wind loads shall not exceed either of the following:

1. $^1/_{175}$ of the length of span of the framing member, for framing members having a length not more than 13 feet 6 inches (4115 mm).
2. $^1/_{240}$ of the length of span of the framing member + $^1/_4$ inch (6.4 mm), for framing members having a length greater than 13 feet 6 inches (4115 mm).

1604.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the effects of added deformations expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided that their effect on the action of the system is considered and provided for in the design. Where a diaphragm is not permitted to be idealized as either flexible or rigid in accordance with ASCE 7 or for wood diaphragms in accordance with AWC SDPWS, the structure shall be analyzed and designed utilizing one of the following procedures:

1. An envelope analysis of the structure using a flexible and rigid diaphragm analysis separately and designing each component for the more severe load condition.
2. A semirigid diaphragm analysis and design.

Where required by ASCE 7, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

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Every structure shall be designed to resist the effects caused by the forces specified in this chapter, including overturning, uplift and sliding. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604.5 Risk category. Each building and structure shall be assigned a risk category in accordance with Table 1604.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein. Where a referenced standard specifies that the assignment of a risk category be in accordance with ASCE 7, Table 1.5-1, Table 1604.5 shall be used in lieu of ASCE 7, Table 1.5-1.

Exceptions:

1. The assignment of buildings and structures to Tsunami Risk Categories III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.
2. Freestanding parking garages not used for the storage of emergency services vehicles or not providing means of egress for buildings or structures assigned to a higher risk category shall be assigned to Risk Category II.

TABLE 1604.5—RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.

III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:
	• Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.
	• Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500.
	• Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, with an occupant load greater than 250.
	• Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500.
	• ***[OSHPD 2]*** *Skilled nursing facilities, intermediate care facilities, Group I-2 occupancy with 50 or more care recipients.*
	• ***[OSHPD 5]*** *Acute psychiatric hospitals, Group I-2 occupancy with 50 or more care recipients.*
	• Group I-3, Condition 1 occupancies.
	• Any other occupancy with an occupant load greater than 5,000.[a]
	• Power-generating stations with individual power units rated 75 MW_{AC} (megawatts, alternating current) or greater, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV.
	• Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that:
	  • Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *California Fire Code*; and
	  • Are sufficient to pose a threat to the public if released.[b]

IV	Buildings and other structures designated as essential facilities and buildings where loss of function represents a substantial hazard to occupants or users, including but not limited to:
	• Group I-2 occupancies. ***[OSHPD 2 & 5]*** *Not adopted by OSHPD.*
	• Ambulatory care facilities having emergency surgery or emergency treatment facilities.
	• Group I-3 occupancies other than Condition 1.
	• Fire, rescue, ambulance and police stations and emergency vehicle garages
	• Designated earthquake, hurricane or other emergency shelters.
	• Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.
	• Public utility facilities providing power generation, potable water treatment, or wastewater treatment.
	• Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.
	• Buildings and other structures containing quantities of highly toxic materials that:
	  • Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *California Fire Code*; and
	  • Are sufficient to pose a threat to the public if released.[b]
	• Aviation control towers, air traffic control centers and emergency aircraft hangars.
	• Buildings and other structures having critical national defense functions.
	• Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load. The floor area for vehicular drive aisles shall be permitted to be excluded in the determination of net floor area in parking garages.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

1604.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified.

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Where a separated portion of a building or structure provides required access to, required egress from or shares life safety systems, designated seismic systems, emergency power systems, or emergency and egress lighting systems with another portion having a higher risk category, or provides required electrical, communications, mechanical, plumbing or conveying support to another portion assigned to Risk Category IV, both portions shall be assigned to the higher risk category.

Exception: Where a storm shelter designed and constructed in accordance with ICC 500 is provided in a building, structure or portion thereof normally occupied for other purposes, the risk category for the normal occupancy of the building shall apply unless the storm shelter is a designated emergency shelter in accordance with Table 1604.5.

1604.5.2 Photovoltaic (PV) panel systems. Photovoltaic (PV) panel systems and elevated PV support structures shall be assigned a risk category as follows:

1. Ground-mounted PV panel systems serving only Group R-3 buildings shall be assigned to Risk Category I.
2. Ground-mounted PV panel systems other than those described in Items 1 and 5 shall be assigned to Risk Category II.
3. Elevated PV support structures other than those described in Items 4, 5 and 6 shall be assigned to Risk Category II.
4. Rooftop-mounted PV panel systems and elevated PV support structures installed on top of buildings shall be assigned to the same risk category as the risk category of the building on which they are mounted.
5. PV panel systems and elevated PV support structures paired with energy storage systems (ESS) and serving as a dedicated, stand-alone source of backup power for Risk Category IV buildings shall be assigned to Risk Category IV.
6. Elevated PV support structures where the usable space underneath is used for parking of emergency vehicles shall be assigned to Risk Category IV.

1604.6 In-situ load tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1708.

1604.7 Preconstruction load tests. Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable referenced standards, or alternative test procedures in accordance with Section 1707, shall be load tested in accordance with Section 1709.

1604.8 Anchorage. Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604.8.1 through 1604.8.3, as applicable.

1604.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

1604.8.2 Structural walls. Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces that result from the application of the prescribed loads. The required earthquake out-of-plane loads are specified in Section 1.4.4 of ASCE 7 for walls of structures assigned to Seismic Design Category A and to Section 12.11 of ASCE 7 for walls of structures assigned to all other seismic design categories. Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements and 1613 for earthquake design requirements.

1604.8.3 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. Connections of decks with cantilevered framing members to exterior walls or other framing members shall be designed for both of the following:

1. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on all portions of the deck.
2. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on the cantilevered portion of the deck, and no live load or snow load on the remaining portion of the deck.

1604.9 Wind and seismic detailing. Lateral force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7 Chapters 11, 12, 13, 15, 17 and 18 as applicable, even where wind load effects are greater than seismic load effects.

Exception: References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.

1604.10 Loads on storm shelters. Loads and load combinations on storm shelters shall be determined in accordance with ICC 500.

SECTION 1605—LOAD COMBINATIONS

1605.1 General. Buildings and other structures and portions thereof shall be designed to resist the strength load combinations specified in ASCE 7, Section 2.3, the allowable stress design load combinations specified in ASCE 7, Section 2.4, or the alternative allowable stress design load combinations of Section 1605.2.

Exceptions:

1. The modifications to load combinations of ASCE 7, Section 2.3, ASCE 7, Section 2.4 and Section 1605.2 specified in ASCE 7 Chapters 18 and 19 shall apply.

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2. Where the allowable stress design load combinations of ASCE 7, Section 2.4 are used, flat roof snow loads of 45 pounds per square foot (2.15 kN/m^2) and roof live loads of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic load. Where flat roof snow loads exceed 45 pounds per square foot (2.15 kN/m^2), 15 percent shall be combined with seismic loads.
3. Where the allowable stress design load combinations of ASCE 7 Section 2.4 are used, crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind loads.
4. Where design for tornado loads is required, the alternative allowable stress design load combinations of Section 1605.2 shall not apply when tornado loads govern the design.

1605.1.1 Stability. Regardless of which load combinations are used to design for strength, where overall structure stability (such as stability against overturning, sliding, or buoyancy) is being verified, use of the load combinations specified in Section 2.3 or 2.4 of ASCE 7, and in Section 1605.2 shall be permitted. Where the load combinations specified in ASCE 7, Section 2.3 are used, strength reduction factors applicable to soil resistance shall be provided by a registered design professional. The stability of retaining walls shall be verified in accordance with Section 1807.2.3.

1605.2 Alternative allowable stress design load combinations. In lieu of the load combinations in ASCE 7, Section 2.4, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. Where using these alternative allowable stress load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. Where using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. Where using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect, E_v, in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero. Where required by ASCE 7, Chapters 12, 13 and 15, the load combinations including overstrength of ASCE 7, Section 2.4.5 shall be used. ***[OSHPD 1R, 2 & 5]*** *Each load combination shall be investigated with one or more of the variable loads set to zero.*

Equation 16-1 $D + L + (L_r \text{ or } 0.7S \text{ or } R)$

Equation 16-2 $D + L + 0.6W$

Equation 16-3 $D + L + 0.6W + 0.7S/2$

Equation 16-4 $D + L + 0.7S + 0.6W/2$

Equation 16-5 $D + L + 0.7S + E/1.4$

Equation 16-6 $0.9D + E/1.4$

Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 45 pounds per square foot (2.15 kN/m^2) or less and roof live loads of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic loads. Where flat roof snow loads exceed 45 pounds per square foot (2.15 kN/m^2), 15 percent shall be combined with seismic loads.

SECTION 1606—DEAD LOADS

1606.1 General. Buildings, structures, and parts thereof shall be designed to resist the effects of dead loads.

1606.2 Weights of materials of construction. For purposes of design, the actual weights of materials of construction shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

1606.3 Weight of fixed service equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.
2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606.4 Photovoltaic panel systems. The weight of photovoltaic panel systems, their support system, and ballast shall be considered as dead load.

1606.5 Vegetative and landscaped roofs. The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as dead load. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe load effects on the structure.

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SECTION 1607—LIVE LOADS

1607.1 General. Buildings, structures, and parts thereof shall be designed to resist the effects of live loads.

TABLE 1607.1—MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
1.	Apartments (see residential)		—	—	—
2.	Access floor systems	Office use	50	2,000	—
		Computer use	100	2,000	—
3.	Armories and drill rooms		150[a]	—	—
4.	Assembly areas	Fixed seats (fastened to floor)	60[a]	—	—
		Lobbies	100[a]		
		Movable seats	100[a]		
		Stage floors	150[a]		
		Platforms (assembly)	100[a]		
		Bleachers, folding and telescopic seating and grandstands	100[a] (See Section 1607.18)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60[a] (See Section 1607.18)		
		Other assembly areas	100[a]		
5.	Balconies and decks		1.5 times the live load for the area served, not required to exceed 100	—	—
6.	Catwalks for maintenance and service access		40	300	—
7.	Cornices		60	—	—
8.	Corridors	First floor	100	—	—
		Other floors	Same as occupancy served except as indicated		
9.	Dining rooms and restaurants		100[a]	—	—
10.	Dwellings (see residential)		—	—	—
11.	Elevator machine room and control room grating (on area of 2 inches by 2 inches)		—	300	—
12.	Finish light floor plate construction (on area of 1 inch by 1 inch)		—	200	—
13.	Fire escapes		100	—	—
		On single-family dwellings only	40		
14.	Fixed ladders		See Section 1607.10		—
15.	Garages and vehicle floors	Passenger vehicle garages	40[c]	See Section 1607.7	—
		Trucks and buses	See Section 1607.8		
		Fire trucks and emergency vehicles	See Section 1607.8		
		Forklifts and movable equipment	See Section 1607.8		
16.	Handrails, guards and grab bars		See Section 1607.9		—
17.	Helipads	Helicopter takeoff weight 3,000 pounds or less	40[a]	See Section 1607.6.1	Section 1607.6
		Helicopter takeoff weight more than 3,000 pounds	60[a]	See Section 1607.6.1	Section 1607.6
18.	Hospitals	Corridors above first floor	80	1,000	—
		Operating rooms, laboratories	60	1,000	
		Patient rooms	40	1,000	
19.	Hotels (see residential)		—	—	—
20.	Libraries	Corridors above first floor	80	1,000	—
		Reading rooms	60	1,000	—
		Stack rooms	150[b]	1,000	Section 1607.17

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TABLE 1607.1—MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS—continued					
OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
21.	Manufacturing	Heavy	250[b]	3,000	—
		Light	125[b]	2,000	
22.	Marquees, except one- and two-family dwellings		75	—	—
23.	Office buildings	Corridors above first floor	80	2,000	—
		File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—	
		Lobbies and first-floor corridors	100	2,000	
		Offices	50	2,000	
24.	Penal institutions	Cell blocks	40	—	—
		Corridors	100		
25.	Public restrooms		Same as live load for area served but not required to exceed 60 psf	—	—
26.	Recreational uses	Bowling alleys, poolrooms and similar uses	75[a]	—	—
		Dance halls and ballrooms	100[a]		
		Gymnasiums	100[a]		
		Theater projection, control, and follow spot rooms	50		
		Ice skating rinks	250[b]		
		Roller skating rinks	100[a]		
27.	Residential	One- and two-family dwellings:		—	Section 1607.21
		Uninhabitable attics without storage	10		
		Uninhabitable attics with storage	20		
		Habitable attics and sleeping areas	30		
		Canopies, including marquees	20		
		All other areas	40		
		Hotels and multifamily dwellings:			
		Private rooms and corridors serving them	40		
		Public rooms	100[a]		
		Corridors serving public rooms	100		
28.	Roofs	Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	—	Section 1607.14
		Roof areas used for assembly purposes	100[a]	—	
		Roof areas used for occupancies other than assembly	Same as occupancy served	—	
		Vegetative and landscaped roofs:			
		Roof areas not intended for occupancy	20	—	
		Roof areas used for assembly purposes	100[a]	—	
		Roof areas used for occupancies other than assembly	Same as occupancy served	—	
		Awnings and canopies:			
		Fabric construction supported by a skeleton structure	5[a]	—	
		All other construction, except one- and two-family dwellings	20	—	

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TABLE 1607.1—MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS—continued					
OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
28.	Roofs—continued	Primary roof members exposed to a work floor:			Section 1607.15
		Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages	—	2,000	
		All other primary roof members	—	300	
		All roof surfaces subject to maintenance workers	—	300	
29.	Schools	Classrooms	40	1,000	—
		Corridors above first floor	80	1,000	
		First-floor corridors	100	1,000	
30.	Scuttles, skylight ribs and accessible ceilings		—	200	—
31.	Sidewalks, vehicular driveways and yards, subject to trucking		250[b]	8,000	Section 1607.19
32.	Stairs and exits	One- and two-family dwellings	40	300	Section 1607.20
		All other	100	300	Section 1607.20
33.	Storage areas above ceilings		20	—	—
34.	Storage warehouses (shall be designed for heavier loads if required for anticipated storage)	Heavy	250[b]	—	—
		Light	125[b]		
35.	Stores	Retail:			—
		First floor	100	1,000	
		Upper floors	75	1,000	
		Wholesale, all floors	125[b]	1,000	
36.	Vehicle barriers		See Section 1607.11		—
37.	Walkways and elevated platforms (other than exitways)		60	—	—
38.	Yards and terraces, pedestrian		100[a]	—	—
39.	***[OSHPD 1R, 2 & 5]*** *Storage racks and wall-hung cabinets.*		Total loads[d]	—	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN.

a. Live load reduction is not permitted.

b. Live load reduction is only permitted in accordance with Section 1607.13.1.2 or Item 1 of Section 1607.13.2.

c. Live load reduction is only permitted in accordance with Section 1607.13.1.3 or Item 2 of Section 1607.13.2.

d. ***[OSHPD 1R, 2 & 5]*** *The minimum vertical design live load shall be as follows:*

Paper media:

12-inch-deep (305 mm) shelf 33 pounds per lineal foot (482 N/m)

15-inch-deep (381 mm) shelf 41 pounds per lineal foot (598 N/m), or

33 pounds per cubic foot (5183 N/m^3) per total volume of the rack or cabinet, whichever is less.

Film media:

18-inch-deep (457 mm) shelf 100 pounds per lineal foot (1459 N/m), or

50 pounds per cubic foot (7853 N/m^3) per total volume of the rack or cabinet, whichever is less.

Other media:

20 pounds per cubic foot (311 N/m^3) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

1607.2 Loads not specified. For occupancies or uses not designated in Section 1607, the live load shall be determined in accordance with a method approved by the building official.

1607.3 Uniform live loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed live loads given in Table 1607.1. Live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.3.1 Partial loading of floors. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. Uniform floor live loads applied to selected spans are permitted to be reduced in accordance with Section 1607.13.

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1607.3.2 Partial loading of roofs. Where uniform roof live loads are reduced to less than 20 pounds per square foot (0.96 kN/m^2) in accordance with Section 1607.14.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect.

1607.4 Concentrated live loads. Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated live loads, given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentrated load shall be assumed to be uniformly distributed over an area of $2^1/_2$ feet by $2^1/_2$ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

1607.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents. The partition load shall be not less than a live load of 15 pounds per square foot (0.72 kN/m^2) and live load reductions in accordance with Section 1607.13 are not permitted to be applied to the partition loads.

Exception: A partition live load is not required where the minimum specified live load is 80 pounds per square foot (3.83 kN/m^2) or greater.

1607.6 Helipads. Helipads shall be marked to indicate the maximum takeoff weight. The takeoff weight limitation shall be indicated in units of thousands of pounds and placed in a box that is located in the bottom right corner of the landing area as viewed from the primary approach path. The box shall be not less than 5 feet (1524 mm) in height.

1607.6.1 Concentrated loads. Helipads shall be designed for the following concentrated live loads:

1. A single concentrated live load, L, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.
2. Two single concentrated live loads, L, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum takeoff weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

1607.7 Passenger vehicle garages. Floors in garages and portions of a building used for the storage of motor vehicles shall be designed for the uniformly distributed live loads indicated in Table 1607.1 or the following concentrated load:

1. For garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds (13.35 kN) acting on an area of 4.5 inches by 4.5 inches (114 mm by 114 mm).
2. For mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds (10 kN) per wheel.

1607.8 Heavy vehicle loads. Floors and other surfaces that are intended to support vehicle loads greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.8.1 through 1607.8.5.

1607.8.1 Loads. Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue, in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

1607.8.2 Fire truck and emergency vehicles. Where a structure or portions of a structure are accessed by fire department vehicles and other similar emergency vehicles, those portions of the structure subject to such loads shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official.
2. The live loading specified in Section 1607.8.1.

Emergency vehicle loads need not be assumed to act concurrently with other uniform live loads.

1607.8.3 Heavy vehicle garages. Garages designed to accommodate vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607.8.1. For garages the design for impact and fatigue is not required.

Exception: The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided that such loads and placement are based on rational engineering principles and are approved by the building official, but shall be not less than 50 psf (2.39 kN/m^2). This live load shall not be reduced.

1607.8.4 Forklifts and movable equipment. Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted in accordance with Section 1607.8.5.

1607.8.4.1 Impact and fatigue. Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

1607.8.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted by the owner or the owner's authorized agent in accordance with Section 106.1.

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1607.9 Loads on handrails, guards, grab bars*, shower seats, dressing room bench* **and seats.** Handrails and guards shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.1. Grab bars, shower seats and accessible benches shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.2.

1607.9.1 Concentrated load. Handrails and guards shall be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7. Glass handrail assemblies and guards shall comply with Section 2407.

1607.9.1.1 Uniform load. Handrails and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1.1 of ASCE 7. This load need not be assumed to act concurrently with the concentrated load specified in Section 1607.9.1.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.9.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).
3. For roofs not intended for occupancy, only the single concentrated load required by Section 1607.9.1 shall be applied.

1607.9.1.2 Guard component loads. Balusters, panel fillers and guard infill components, including all rails except the handrail and the top rail, shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1.2 of ASCE 7.

1607.9.2 Grab bars, shower seats and accessible benches. Grab bars, shower seats and accessible benches shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar, shower seat, or seat of the accessible bench so as to produce the maximum load effects. ***[DSA-AC & HCD 1-AC]*** *See Chapter 11A, Section 1127A.4 and Chapter 11B, Sections 11B-609.8, 11B-610.4 and 11B-903.6 for grab bars, shower seats and dressing room bench seats, as applicable.*

** **1607.10 Fixed ladders.** Fixed ladders with rungs shall be designed to resist a single concentrated load of 300 pounds (1.33 kN) in accordance with Section 4.5.4 of ASCE 7. Where rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall be designed to resist a single concentrated load of 100 pounds (0.445 kN) in accordance with Section 4.5.4 of ASCE 7. Ship's ladders shall be designed to resist the stair loads given in Table 1607.1.

1607.11 Vehicle barriers. Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provisions for traffic railings.

1607.12 Impact loads. The live loads specified in Sections 1607.3 through 1607.11 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.12.1 Elevators. Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1/CSA B44.

1607.12.2 Machinery. For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact:

1. Light machinery, shaft- or motor-driven, 20 percent.
2. Reciprocating machinery or power-driven units, 50 percent.

Percentages shall be increased where specified by the manufacturer.

1607.12.3 Elements supporting hoists for façade access and building maintenance equipment. In addition to any other applicable live loads, structural elements that support hoists for façade access and building maintenance equipment shall be designed for a live load of 2.5 times the rated load of the hoist or the stall load of the hoist, whichever is larger.

1607.12.4 Fall arrest, lifeline, and rope descent system anchorages. In addition to any other applicable live loads, fall arrest, lifeline, and rope descent system anchorages and structural elements that support these anchorages shall be designed for a live load of not less than 3,100 pounds (13.8 kN) for each attached line, in any direction that the load can be applied.

Note: *California Division of Occupational Safety and Health requirements for anchorages used for attachment of personal fall arrest equipment are contained in Division 1, Chapter 4, Subchapter 4, Article 24, Section 1670(b)(10) (Title 8, California Code of Regulations).*

Anchorages of horizontal lifelines and the structural elements that support these anchorages shall be designed for the maximum tension that develops in the horizontal lifeline from these live loads.

1607.13 Reduction in uniform live loads. Except for uniform roof live loads, all other minimum uniformly distributed live loads, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.13.1 or 1607.13.2. Uniform roof live loads are permitted to be reduced in accordance with Section 1607.14.

1607.13.1 Basic uniform live load reduction. Subject to the limitations of Sections 1607.13.1.1 through 1607.13.1.3 and Table 1607.1, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m^2) or more are permitted to be designed for a reduced uniformly distributed live load, L, in accordance with the following equation:

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Equation 16-7 $$L = L_o\left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}}\right)$$

For SI: $$L = L_o\left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}}\right)$$

where:

L = Reduced design live load per square foot (m^2) of area supported by the member.

L_o = Unreduced design live load per square foot (m^2) of area supported by the member (see Table 1607.1).

K_{LL} = Live load element factor (see Table 1607.13.1).

A_T = Tributary area, in square feet (m^2).

L shall be not less than $0.50L_o$ for members supporting one floor and L shall be not less than $0.40L_o$ for members supporting two or more floors.

TABLE 1607.13.1—LIVE LOAD ELEMENT FACTOR, K_{LL}

ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
Members not previously identified including:	1
Edge beams with cantilever slabs	
Cantilever beams	
One-way slabs	
Two-way slabs	
Members without provisions for continuous shear transfer normal to their span	

1607.13.1.1 One-way slabs. The tributary area, A_T, for use in Equation 16-7 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

1607.13.1.2 Heavy live loads. Live loads that exceed 100 psf (4.79 kN/m^2) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the reduced live load shall be not less than L as calculated in Section 1607.13.1.
2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

1607.13.1.3 Passenger vehicle garages. The live loads shall not be reduced in passenger vehicle garages.

Exception: The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the reduced live load shall be not less than L as calculated in Section 1607.13.1.

1607.13.2 Alternative uniform live load reduction. As an alternative to Section 1607.13.1 and subject to the limitations of Table 1607.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. For live loads not exceeding 100 pounds per square foot (4.79 kN/m^2), the design live load for structural members supporting 150 square feet (13.94 m^2) or more is permitted to be reduced in accordance with Equation 16-8.

Equation 16-8 $R = 0.08(A - 150)$

For SI: $R = 0.861(A - 13.94)$

where:

A = Area of floor supported by the member, square feet (m^2).

R = Reduction in percent. Such reduction shall not exceed the smallest of:

1.1. 40 percent for members supporting one floor.

1.2. 60 percent for members supporting two or more floors.

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1.3. R as determined by the following equation:

Equation 16-9 $R = 23.1(1+ D/L_o)$

where:

D = *Dead load* per square foot (m²) of area supported.

L_o = Unreduced live load per square foot (m²) of area supported.

2. A reduction shall not be permitted where the live load exceeds 100 pounds per square foot (4.79 kN/m²) except that the design live load for members supporting two or more floors is permitted to be reduced by not greater than 20 percent.

   Exception: For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

3. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent.

4. For one-way slabs, the area, A, for use in Equation 16-8 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

1607.14 Reduction in uniform roof live loads. The minimum uniformly distributed live loads of roofs, marquees and canopies, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.14.1.

1607.14.1 Ordinary roofs, awnings and canopies. Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load, L_r, as specified in the following equations or other controlling combinations of loads as specified in Section 1605, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m²).

Equation 16-10 $L_r = L_o R_1 R_2$

where: $12 \le L_r \le 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \le L_r \le 0.96$

L_o = Unreduced roof live load per square foot (m²) of horizontal projection supported by the member (see Table 1607.1).

L_r = Reduced roof live load per square foot (m²) of horizontal projection supported by the member.

The reduction factors R_1 and R_2 shall be determined as follows:

Equation 16-11 $R_1 = 1$ for $A_t \le 200$ square feet (18.58 m²)

Equation 16-12 $R_1 = 1.2 - 0.001A_t$ for 200 square feet $< A_t <$ 600 square feet

Equation 16-13 $R_1 = 0.6$ for $A_t \ge 600$ square feet (55.74 m²)

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m²) supported by the member, and

Equation 16-14 $R_2 = 1$ for $F \le 4$

Equation 16-15 $R_2 = 1.2 - 0.05F$ for $4 < F < 12$

Equation 16-16 $R_2 = 0.6$ for $F \ge 12$

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607.14.2 Occupiable roofs. Areas of roofs that are occupiable, such as vegetative roofs, landscaped roofs or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607.13.

*

1607.15 Crane loads. The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall be in accordance with Section 4.9 of ASCE 7.

1607.16 Interior walls and partitions. Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m²).

1607.16.1 Fabric partitions. Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the following load conditions:

1. The horizontal distributed load need only be applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.

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2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch-diameter (203 mm) area [50.3 square inches (32 452 mm^2)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

1607.16.2 Fire walls. In order to meet the structural stability requirements of Section 706.2 where the structure on either side of the wall has collapsed, fire walls and their supports shall be designed to withstand a minimum horizontal allowable stress load of 5 psf (0.240 kN/m^2).

1607.17 Library stack rooms. The live loading indicated in Table 1607.1 for library stack rooms applies to stack room floors that support nonmobile, double-faced library book stacks, subject to the following limitations:

1. The nominal book stack unit height shall not exceed 90 inches (2290 mm).
2. The nominal shelf depth shall not exceed 12 inches (305 mm) for each face.
3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches (914 mm) in width.

1607.18 Seating for assembly uses. Bleachers, folding and telescopic seating and grandstands shall be designed for the loads specified in ICC 300. Stadiums and arenas with fixed seats shall be designed for the horizontal sway loads in Section 1607.18.1.

1607.18.1 Horizontal sway loads. The design of stadiums and arenas with fixed seats shall include horizontal swaying forces applied to each row of seats as follows:

1. 24 pounds per linear foot (0.35 kN/m) of seat applied in a direction parallel to each row of seats.
2. 10 pounds per linear foot (0.15 kN/m) of seat applied in a direction perpendicular to each row of seats.

The parallel and perpendicular horizontal swaying forces are not required to be applied simultaneously.

1607.19 Sidewalks, vehicular driveways, and yards subject to trucking. The live loading indicated in Table 1607.1 for sidewalks, vehicular driveways, and yards subject to trucking shall comply with the requirements of this section.

1607.19.1 Uniform loads. In addition to the loads indicated in Table 1607.1, other uniform loads in accordance with an approved method that contains provisions for truck loading shall be considered where appropriate.

1607.19.2 Concentrated loads. The concentrated wheel *load* indicated in Table 1607.1 shall be applied on an area of $4^1/_2$ inches by $4^1/_2$ inches (114 mm by 114 mm).

1607.20 Stair treads. The concentrated load indicated in Table 1607.1 for stair treads shall be applied on an area of 2 inches by 2 inches (51 mm by 51 mm). This load need not be assumed to act concurrently with the uniform load.

1607.21 Residential attics. The live loads indicated in Table 1607.1 for attics in residential occupancies shall comply with the requirements of this section.

1607.21.1 Uninhabitable attics without storage. In residential occupancies, uninhabitable attic areas without storage are those where the maximum clear height between the joists and rafters is less than 42 inches (1067 mm), or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607.1 need not be assumed to act concurrently with any other live load requirement.

1607.21.2 Uninhabitable attics with storage. In residential occupancies, uninhabitable attic areas with storage are those where the maximum clear height between the joist and rafter is 42 inches (1067 mm) or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607.1 need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches (508 mm) in width by 30 inches (762 mm) in length that is located where the clear height in the attic is not less than 30 inches (762 mm).
2. The slope of the joists or truss bottom chords is not greater than 2 units vertical in 12 units horizontal.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot (0.48 kN/m^2).

1607.21.3 Attics served by stairs. Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

1607.22 Photovoltaic panel systems. Roof structures that provide support for photovoltaic panel systems shall be designed in accordance with Sections 1607.22.1 through 1607.22.5, as applicable. **

1607.22.1 Roof live load. Roof structures that support photovoltaic panel systems shall be designed to resist each of the following conditions:

1. Applicable uniform and concentrated roof loads with the photovoltaic panel system dead loads.

   Exception: Roof live loads need not be applied to the area covered by photovoltaic panels where the clear space between the panels and the roof surface is 24 inches (610 mm) or less.
2. Applicable uniform and concentrated roof loads without the photovoltaic panel system present.

1607.22.2 Photovoltaic panels or modules. The structure of a roof that supports solar photovoltaic panels or modules shall be designed to accommodate the full solar photovoltaic panels or modules and ballast dead load, including concentrated loads from support frames in combination with the loads from Section 1607.22.1 and other applicable loads. Where applicable, snow drift loads created by the photovoltaic panels or modules shall be included.

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1607.22.3 Elevated photovoltaic (PV) support structures with open grid framing. Elevated photovoltaic (PV) support structures with open grid framing and without a roof deck or sheathing shall be designed to support the uniform and concentrated roof live loads specified in Section 1607.22.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m^2).

1607.22.4 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic (PV) panel systems are not required to accommodate a roof live load. Other loads and combinations in accordance with Section 1605 shall be accommodated.

1607.22.5 Ballasted photovoltaic panel systems. Roof structures that provide support for ballasted photovoltaic panel systems shall be designed, or analyzed, in accordance with Section 1604.4; checked in accordance with Section 1604.3.6 for deflections; and checked in accordance with Section 1611 for ponding. ***[OSHPD 1R, 2 & 5]*** *Ballasted photovoltaic panel systems shall be considered as an alternative system.*

SECTION 1608—SNOW LOADS

1608.1 General. Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall be not less than that determined by Section 1607.

Exception: Temporary structures complying with Section 3103.6.1.1.

1608.2 Ground snow loads. The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with the reliability-targeted (strength based) ground snow load values in Chapter 7 of ASCE 7 or Figures 1608.2(1) through 1608.2(4) for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be determined in accordance with Chapter 7 of ASCE 7 and shall be approved by the building official. Snow loads are zero for Hawaii, except in mountainous regions as approved by the building official.

TABLE 1608.2—GROUND SNOW LOADS, p_g, FOR ALASKAN LOCATIONS

CITY/TOWN	ELEVATION (ft)	GROUND SNOW LOAD, p_g[a, b, c] (lb/ft^2)			
		RISK CATEGORY			
		I	II	III	IV
Adek	100	32	40	46	50
Anchorage/Eagle River[c]	500	64	80	92	100
Arctic Village	2,100	38	48	55	60
Bethel	100	51	64	74	80
Bettles	700	102	128	147	160
Cantwell	2,100	109	136	156	170
Cold Bay	100	45	56	64	70
Cordova	100	128	160	184	200
Deadhorse	100	32	40	46	50
Delta Junction	400	51	64	74	80
Dillingham	100	141	176	202	220
Emmonak	100	128	160	184	200
Fairbanks	1,200	77	96	110	120
Fort Yukon	400	64	80	92	100
Galena	200	77	96	110	120
Girdwood	200	179	224	258	280
Glennallen	1,400	58	72	83	90
Haines	100	237	296	340	370
Holy Cross	100	154	192	221	240
Homer [c]	500	58	72	83	90
Iliamna	200	102	128	147	160
Juneau	100	90	112	129	140
Kaktovik	100	58	72	83	90
Kenai/Soldotna	200	83	104	120	130
Ketchikan	100	38	48	55	60
Kobuk	200	115	144	166	180
Kodiak	100	45	56	64	70
Kotzebue	100	77	96	110	120
McGrath	400	83	104	120	130
Nenana	400	96	120	138	150
Nikiski	200	102	128	147	160

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TABLE 1608.2—GROUND SNOW LOADS, p_g, FOR ALASKAN LOCATIONS-continued					
CITY/TOWN	ELEVATION (ft)	GROUND SNOW LOAD, p_g [a, b, c] (lb/ft^2)			
		RISK CATEGORY			
		I	II	III	IV
Nome	100	90	112	129	140
Palmer/Wasilla	500	64	80	92	100
Petersburg	100	122	152	175	190
Point Hope	100	58	72	83	90
Saint Lawrence Island	100	122	152	175	190
Saint Paul Islands	100	51	64	74	80
Seward	100	77	96	110	120
Sitka	100	64	80	92	100
Talkeetna	400	154	192	221	240
Tok	1,700	45	56	64	70
Umiat	300	38	48	55	60
Unalakleet	100	45	56	64	70
Unalaska	100	96	120	138	150
Utqiagvik (Barrow)	100	32	40	46	50
Valdez	100	205	256	294	320
Wainwright	100	32	40	46	50
Whittier	100	346	432	497	540
Willow	300	102	128	147	160
Yakutat	100	179	224	258	280

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Statutory requirements of the building official are not included in this state ground snow load table.

b. For locations where there is substantial change in altitude over the city/town, the load applies at and below the cited elevation within the jurisdiction and up to 100 feet above the cited elevation unless otherwise noted.

c. For locations in Anchorage/Eagle River and Homer above the cited elevation, the ground snow load shall be increased by 15 percent for every 100 feet above the cited elevation.

1608.2.1 Ground snow conversion. Where required, the ground snow loads, p_g, of Figures 1608.2(1) through 1608.2(4) and Table 1608.2 shall be converted to allowable stress design ground snow loads, $p_{g(asd)}$, using Equation 16-17.

Equation 16-17 $p_{g(asd)} = 0.7p_g$

where:

$p_{g(asd)}$ = Allowable stress design ground snow load.

p_g = Ground snow load determined from Figures 1608.2(1) through 1608.2(4) and Table 1608.2.

1608.3 Ponding instability. Ponding instability on roofs shall be evaluated in accordance with ASCE 7.

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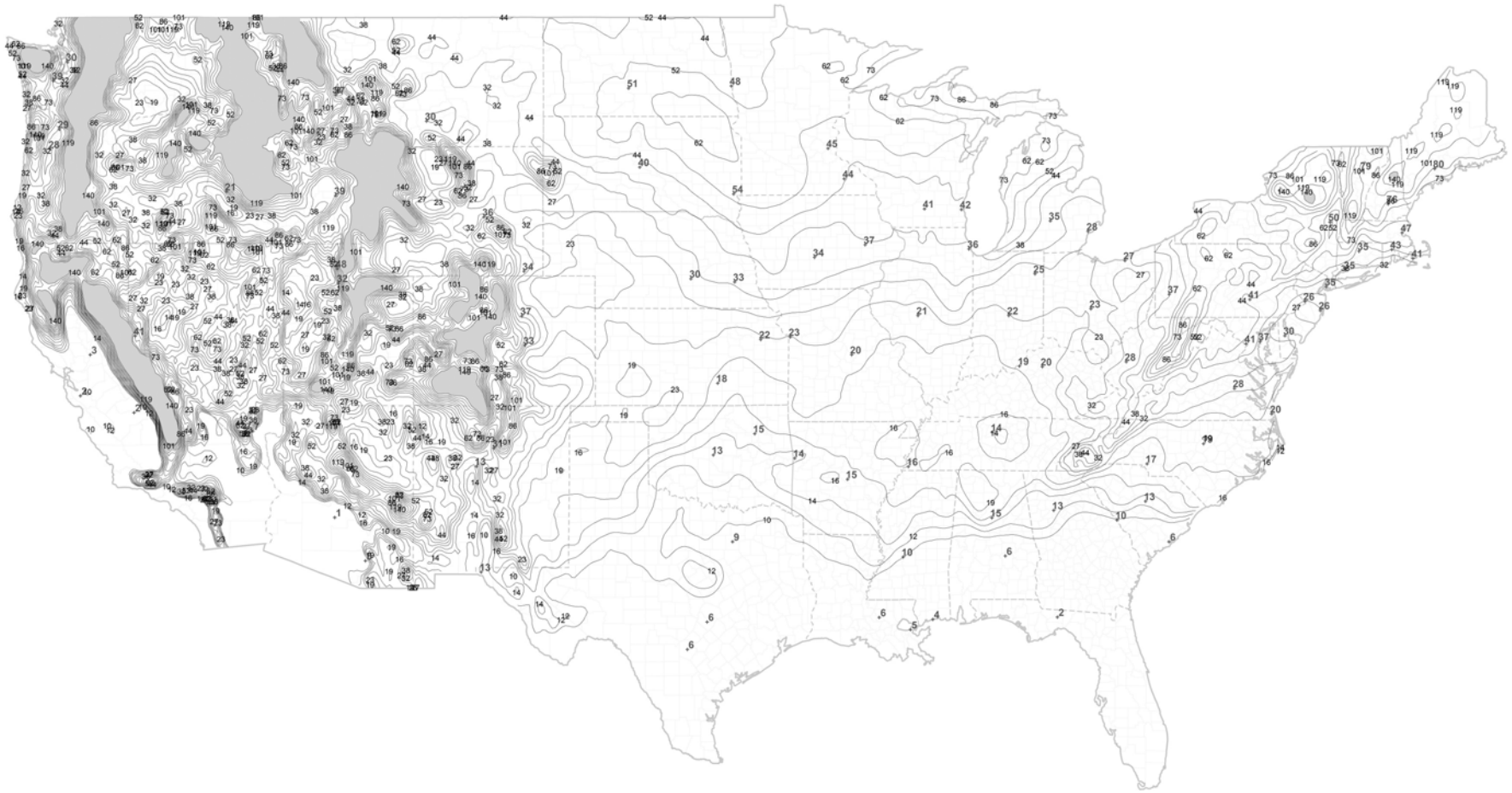

FIGURE 1608.2(1)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY I FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2. Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

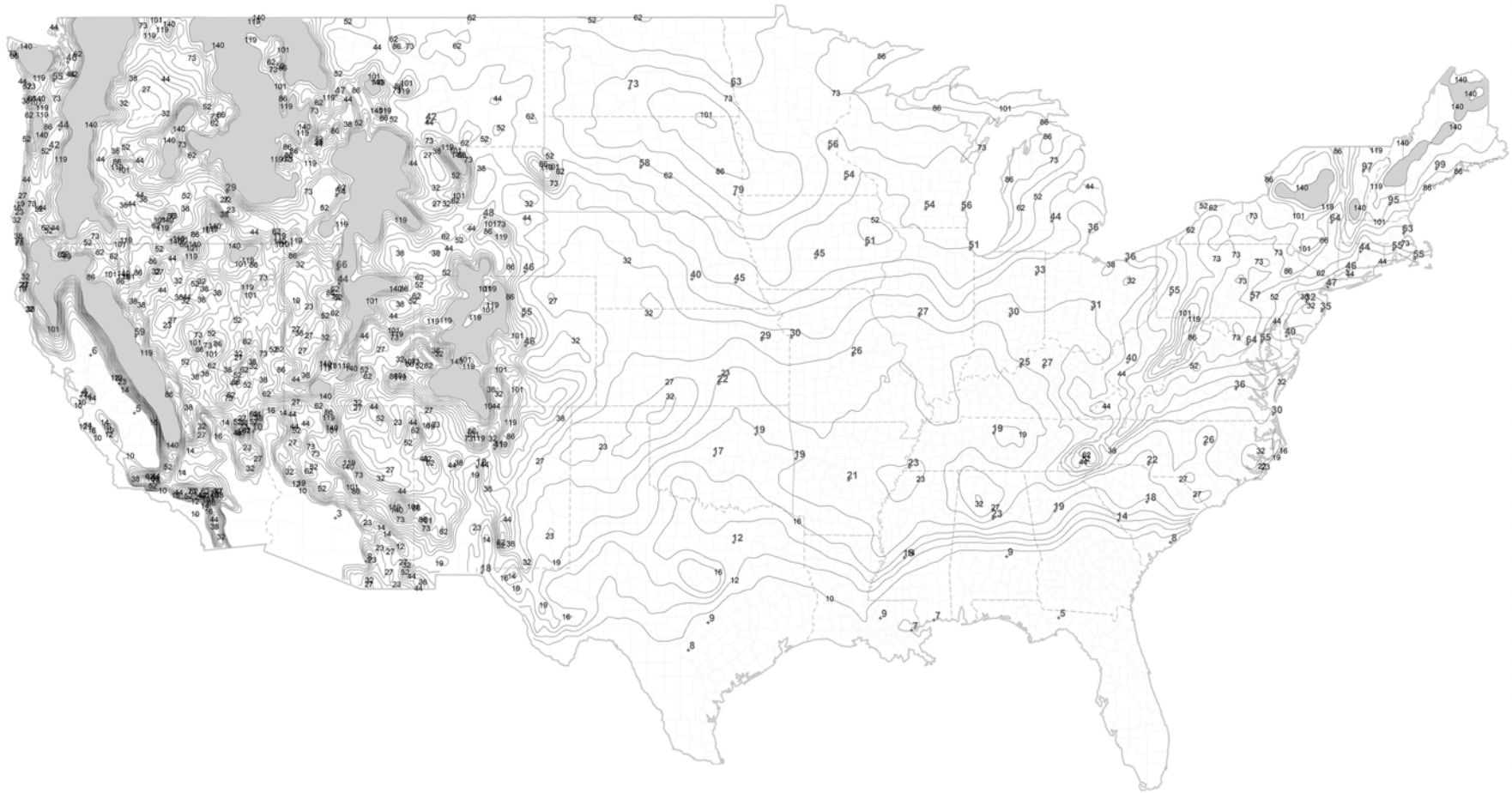

FIGURE 1608.2(2)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY II FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2.

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or an approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

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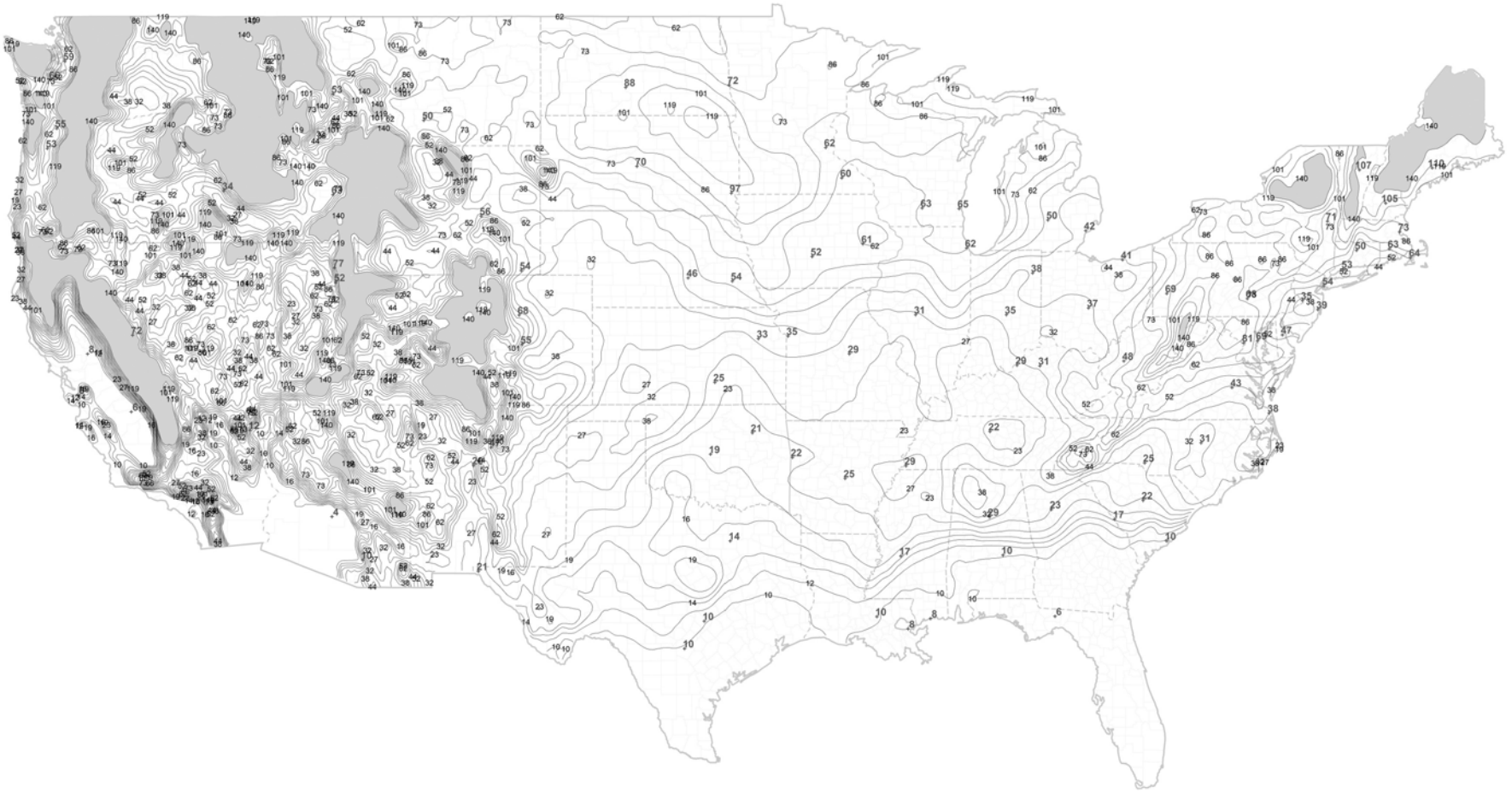

FIGURE 1608.2(3)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY III FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2.

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or an approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

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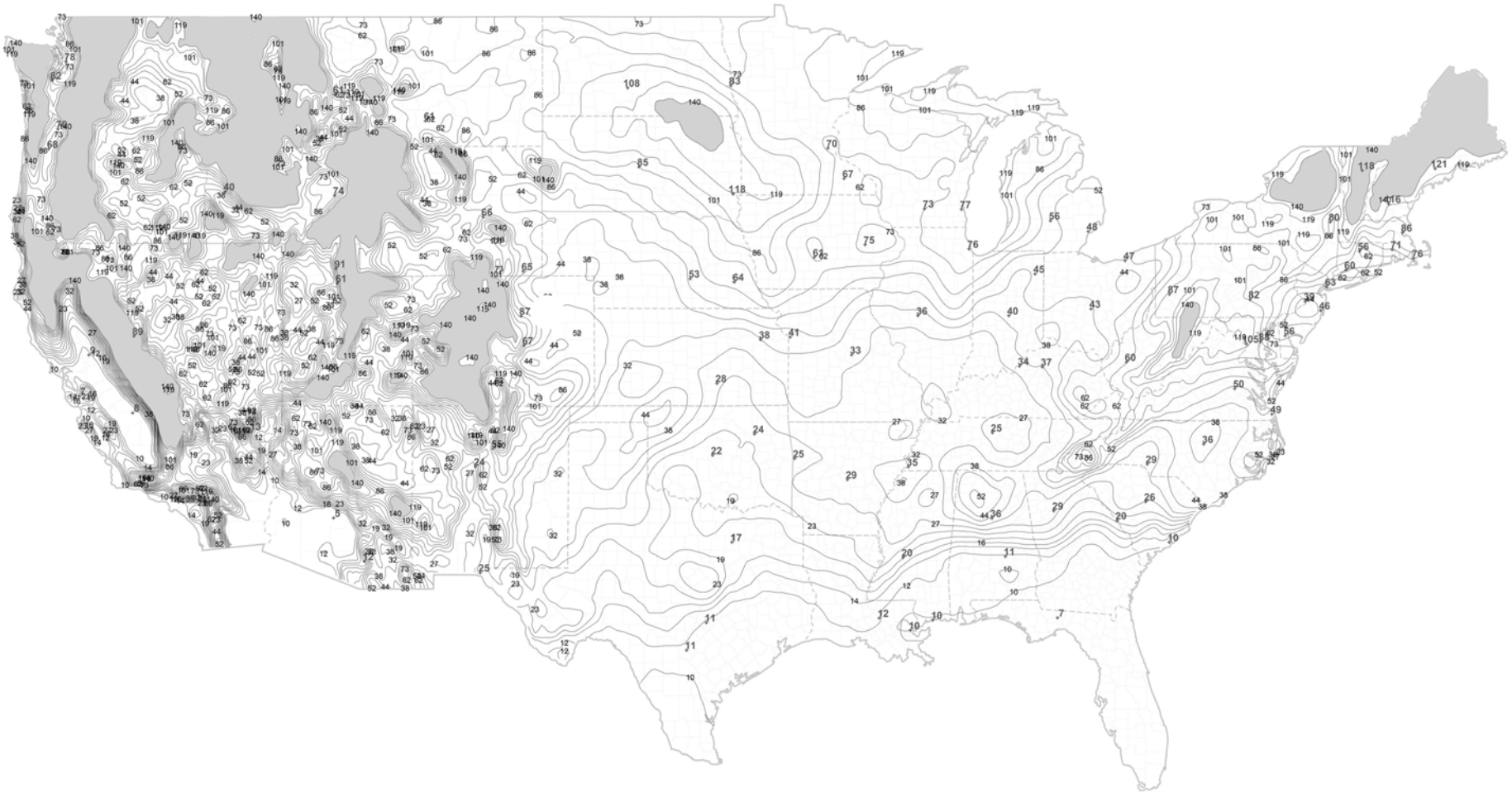

FIGURE 1608.2(4)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY IV FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2.

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or an approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

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SECTION 1609—WIND LOADS

1609.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic wind speed, *V*, and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.7 of ASCE 7.
7. Temporary structures complying with Section 3103.6.1.2.

The wind speeds in Figures 1609.3(1) through 1609.3(4) are basic wind speeds, *V*, and shall be converted in accordance with Section 1609.3.1 to allowable stress design wind speeds, V_{asd}, when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1609.1.1.1 Applicability. The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of ICC 600, AWC WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting all of the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C.
2. The maximum average slope of the hill exceeds 10 percent.
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 2 miles (3.22 km), whichever is greater.

1609.2 Protection of openings. In windborne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resistant standard or ASTM E1996 referenced herein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E1996.
2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E1996.

Exceptions:

1. Wood structural panels with a minimum thickness of $^{7}/_{16}$ inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in buildings with a mean roof height of 33 feet (10 058 mm) or less that are classified as a Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where V_{asd} determined in accordance with Section 1609.3.1 does not exceed 140 mph (63 m/s).
2. Glazing in Risk Category I buildings, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in Risk Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (457 m) of the building shall be permitted to be unprotected.

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TABLE 1609.2—WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS[a, b, c, d]

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
$^1/_4$-inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

a. This table is based a on 140 mph basic wind speed, *V*, and a 45-foot mean roof height.

b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located not less than 1 inch from the edge of the panel.

c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located not less than $2^1/_2$ inches from the edge of concrete block or concrete.

d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

1609.2.1 Louvers. Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet the requirements of AMCA 540.

1609.2.2 Garage doors. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

1609.3 Basic wind speed. The basic wind speed, *V*, in mph, for the determination of the wind loads shall be determined by Figures 1609.3(1) through 1609.3(4). ⬅

The basic wind speed, *V*, for use in the design of Risk Category I buildings and structures shall be obtained from Figure 1609.3(1).

The basic wind speed, *V*, for use in the design of Risk Category II buildings and structures shall be obtained from Figure 1609.3(2).

The basic wind speed, *V*, for use in the design of Risk Category III buildings and structures shall be obtained from Figure 1609.3(3).

The basic wind speed, *V*, for use in the design of Risk Category IV buildings and structures shall be obtained from Figure 1609.3(4).

Basic wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined by using the ASCE Wind Design Geodatabase. The ASCE Wind Design Geodatabase is available at https://asce7hazardtool.online, or an approved equivalent.

The basic wind speed, *V*, for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The basic wind speeds, *V*, determined by the local jurisdiction shall be in accordance with Chapter 26 of ASCE 7.

In nonhurricane-prone regions, when the basic wind speed, *V*, is estimated from regional climatic data, the basic wind speed, *V*, shall be determined in accordance with Chapter 26 of ASCE 7.

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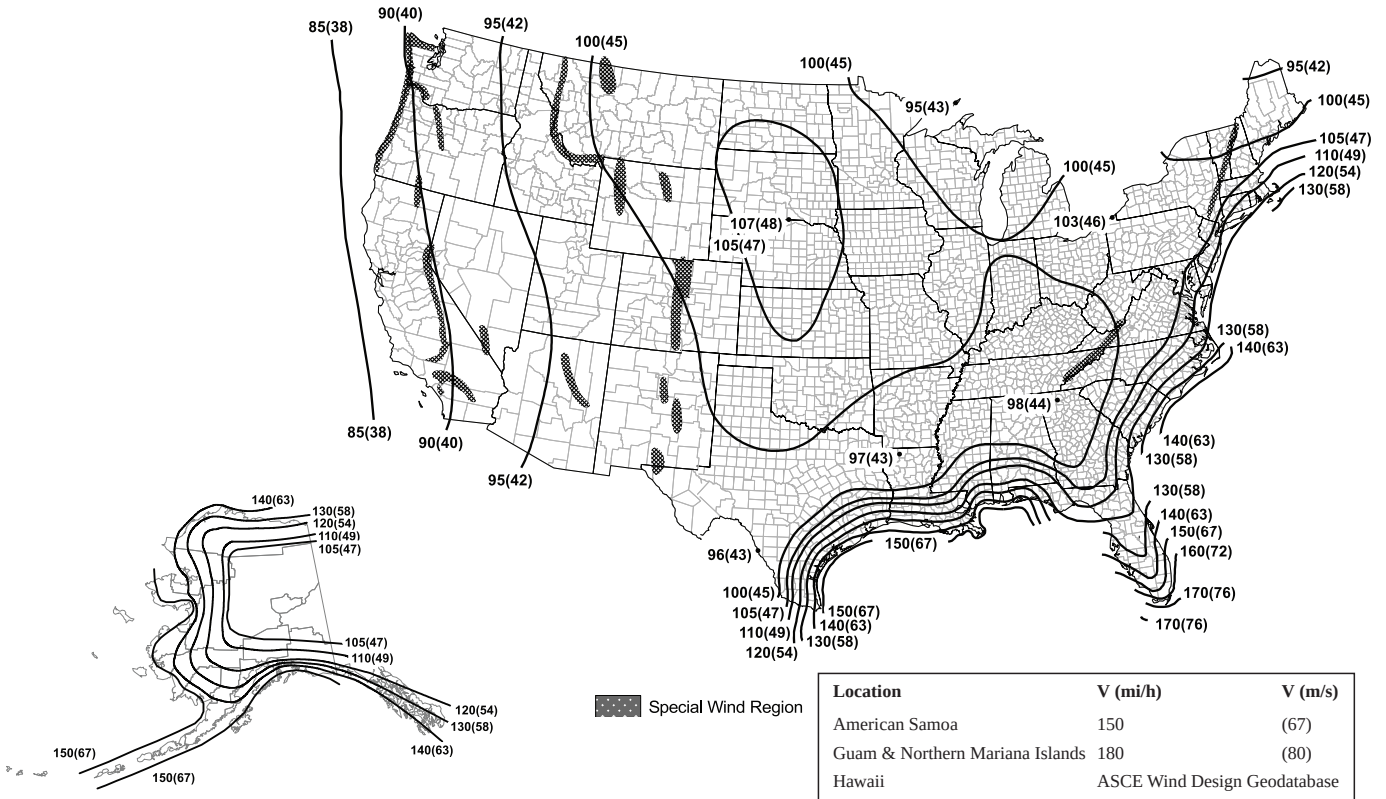
FIGURE 1609.3(1)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES



Location	V (mi/h)	V (m/s)
American Samoa	150	(67)
Guam & Northern Mariana Islands	180	(80)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 15-percent probability of exceedance in 50 years (annual exceedance probability = 0.00333, MRI = 300 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

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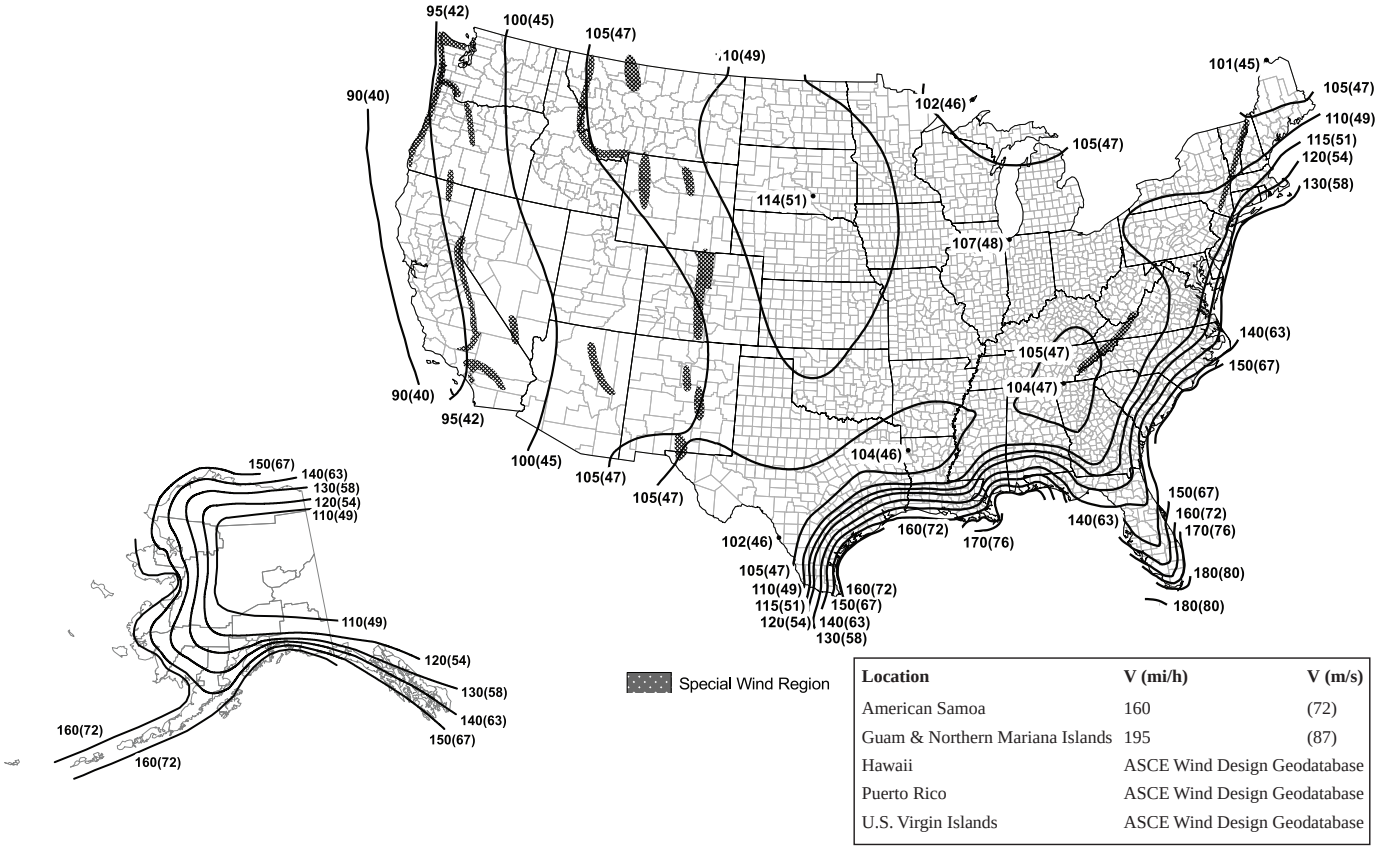
FIGURE 1609.3(2)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES

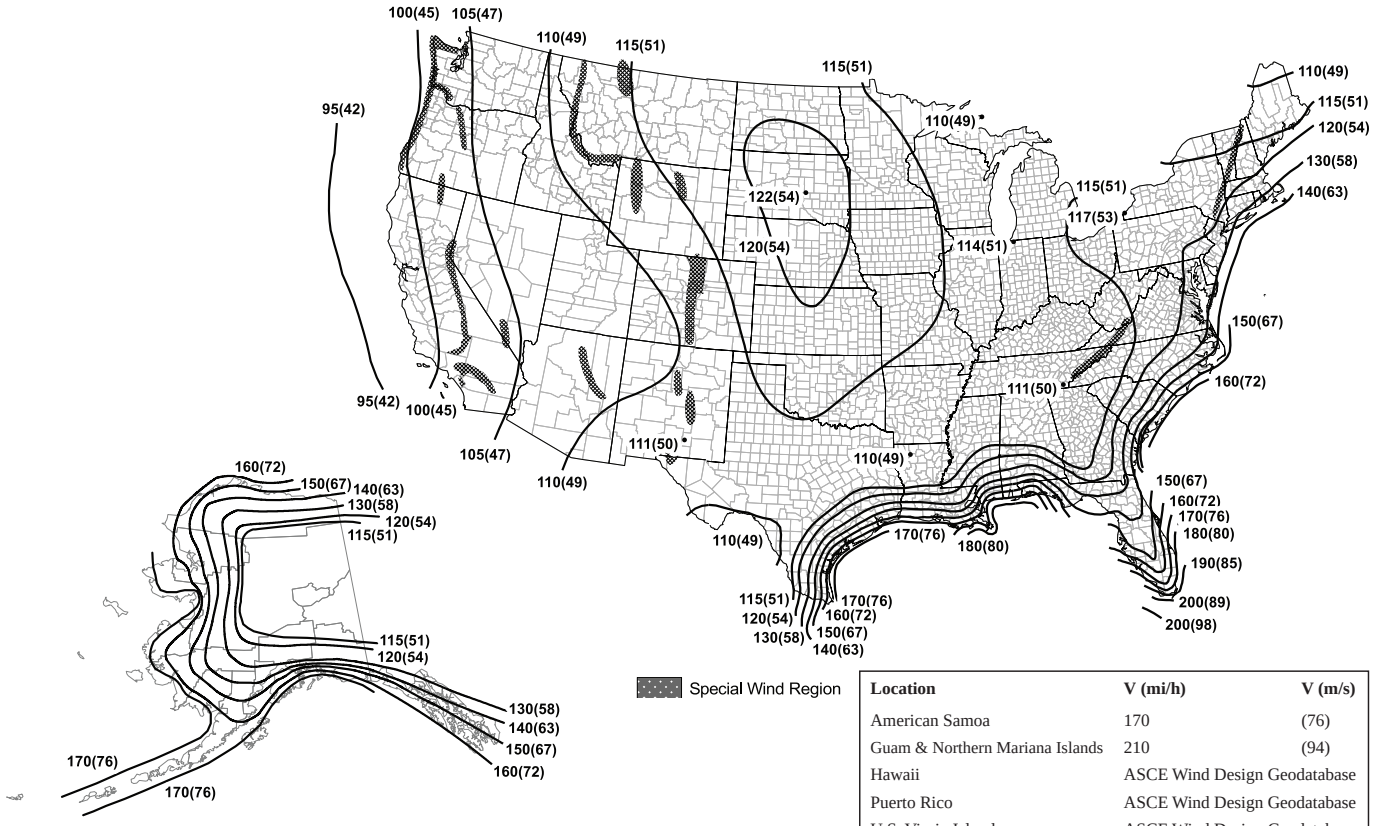


Location	V (mi/h)	V (m/s)
American Samoa	160	(72)
Guam & Northern Mariana Islands	195	(87)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 7-percent probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

FIGURE 1609.3(3)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES

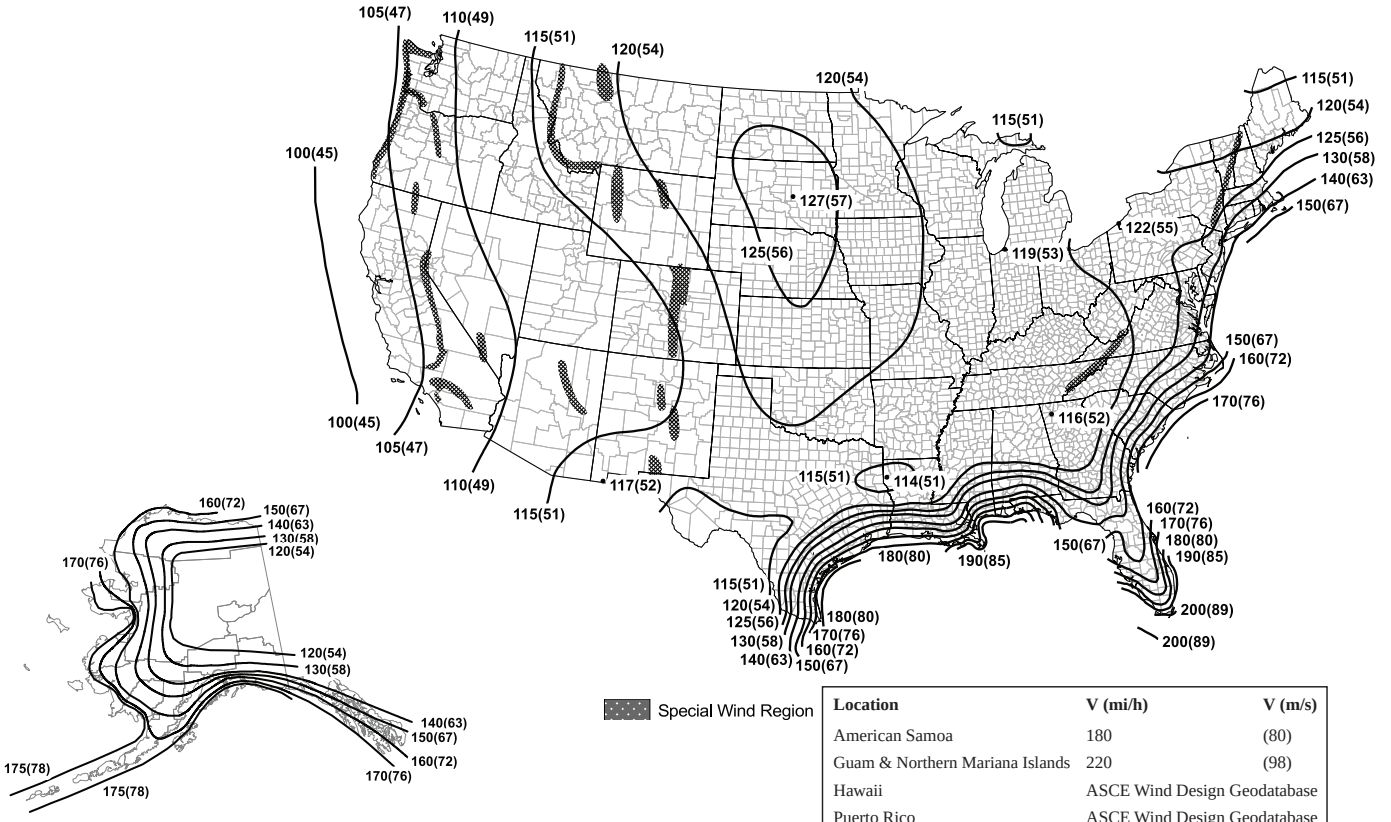


Location	V (mi/h)	V (m/s)
American Samoa	170	(76)
Guam & Northern Mariana Islands	210	(94)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 3-percent probability of exceedance in 50 years (annual exceedance probability = 0.000588, MRI = 1,700 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

FIGURE 1609.3(4)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES



Location	V (mi/h)	V (m/s)
American Samoa	180	(80)
Guam & Northern Mariana Islands	220	(98)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 1.6-percent probability of exceedance in 50 years (annual exceedance probability = 0.00033, MRI = 3,000 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

1609.3.1 Wind speed conversion. Where required, the basic wind speeds of Figures 1609.3(1) through 1609.3(4) shall be converted to allowable stress design wind speeds, V_{asd}, using Table 1609.3.1 or Equation 16-18.

Equation 16-18 $V_{asd} = V\sqrt{0.6}$

where:

V_{asd} = Allowable stress design wind speed applicable to methods specified in Exceptions 4 and 5 of Section 1609.1.1.

V = Basic wind speeds determined from Figures 1609.3(1) through 1609.3(4).

TABLE 1609.3.1—WIND SPEED CONVERSIONS[a, b, c]

V	100	110	120	130	140	150	160	170	180	190	200
V_{asd}	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

a. Linear interpolation is permitted.

b. V_{asd} = allowable stress design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.

c. V = basic wind speeds determined from Figures 1609.3(1) through 1609.3(4).

1609.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

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1609.4.1 Wind directions and sectors. For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the following categories, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.

Surface Roughness D. Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

1609.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

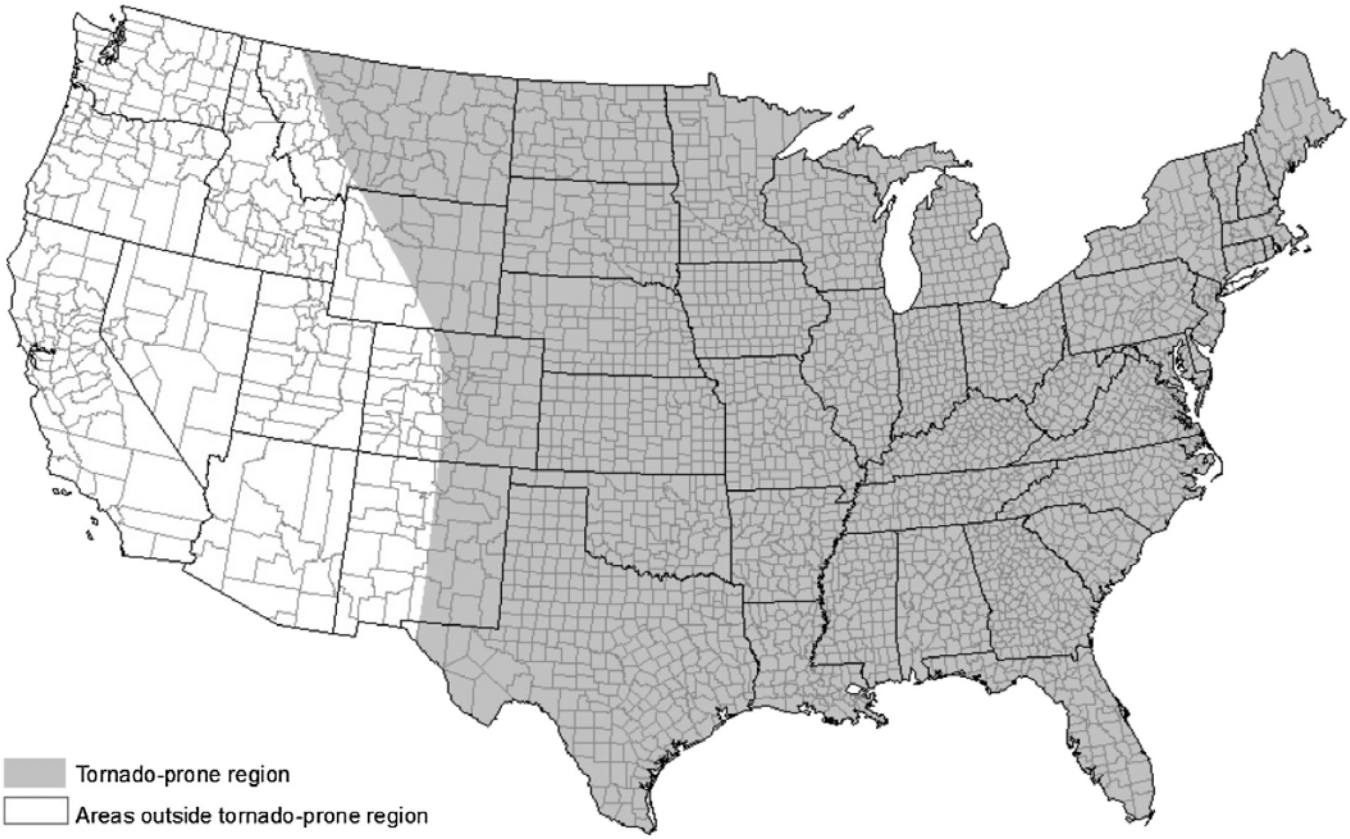
Exposure B. For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of not less than 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of not less than 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exposure C. Exposure C shall apply for all cases where Exposure B or D does not apply.

Exposure D. Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of not less than 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building height, whichever is greater, from an Exposure D condition as defined in the previous sentence.

1609.5 Tornado loads. The design and construction of Risk Category III and IV buildings and other structures located in the tornado-prone region as shown in Figure 1609.5 shall be in accordance with Chapter 32 of ASCE 7, except as modified by this code.

FIGURE 1609.5—TORNADO-PRONE REGION



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1609.6 Roof systems. Roof systems shall be designed and constructed in accordance with Sections 1609.6.1 through 1609.6.3, as applicable.

1609.6.1 Roof deck. The roof deck shall be designed to withstand the greater of wind pressures or tornado pressures determined in accordance with ASCE 7.

1609.6.2 Roof coverings. Roof coverings shall comply with Section 1609.6.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.6.1 are permitted to be designed in accordance with Section 1609.6.3.

1609.6.2.1 Asphalt shingles. Asphalt shingles installed over a roof deck complying with Section 1609.6.1 shall comply with the wind-resistance requirements of Section 1504.2.

1609.6.3 Rigid tile. Wind and tornado loads on rigid tiles shall comply with Section 1609.6.3.1 or 1609.6.3.2, as applicable.

1609.6.3.1 Aerodynamic uplift moment. The aerodynamic uplift moment for rigid tile roof coverings shall be determined in accordance with the following equation:

Equation 16-19 $M_a = q_h K_d C_L b L L_a [1.0 - GC_p]$

For SI: $M_a = q_h K_d C_L b L L_a [1.0 - GC_p] / 1000$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1504.3.1.

GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

K_d = Wind directionality factor determined from Chapter 26 of ASCE 7.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

q_h = Wind velocity pressure, psf (kN/m^2) determined from Section 26.10.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing that has been designed as components and cladding.
3. An underlayment shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have not less than two-thirds of the tile's area free of mortar or adhesive contact.

1609.6.3.2 Tornado loads. Tornado loads on rigid tile roof coverings shall be determined in accordance with Section 1609.6.3.1, replacing q_h with q_{hT} and (GC_p) with $K_{vT}(GC_p)$ in Equation 16-19, where:

q_{hT} = tornado velocity pressure, pounds per square foot (kN/m^2) determined in accordance with Section 32.10 of ASCE 7.

K_{vT} = tornado pressure coefficient adjustment factor for vertical winds, determined in accordance with Section 32.14 of ASCE 7.

1609.7 Elevators, escalators and other conveying systems. Elevators, escalators and other conveying systems and their components exposed to outdoor environments shall satisfy the wind design requirements of ASCE 7.

SECTION 1610—SOIL LOADS AND HYDROSTATIC PRESSURE

1610.1 Lateral pressures. Structures below grade shall be designed to resist lateral soil loads from adjacent soil. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Walls that are free to move and rotate at the top, such as retaining walls, shall be permitted to be designed for active pressure.

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Where applicable, lateral pressure from fixed or moving surcharge loads shall be added to the lateral soil load. Lateral pressure shall be increased if expansive soils are present at the site. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805.4.2 and 1805.4.3.

Exception: Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

TABLE 1610.1—LATERAL SOIL LOAD

DESCRIPTION OF BACKFILL MATERIAL[c]	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD[a] (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.

b. Unsuitable as backfill material.

c. The definition and classification of soil materials shall be in accordance with ASTM D2487.

1610.2 Uplift loads on floor and foundations. Basement floors, slabs on ground, foundations, and similar approximately horizontal elements below grade shall be designed to resist uplift loads where applicable. The upward pressure of water shall be taken as the full hydrostatic pressure applied over the entire area. The hydrostatic load shall be measured from the underside of the element being evaluated. The design for upward loads caused by expansive soils shall comply with Section 1808.6.

SECTION 1611—RAIN LOADS

1611.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater as per the requirements of Chapter 8 of ASCE 7. Rain loads shall be based on the summation of the static head, d_s, hydraulic head, d_h, and ponding head, d_p, using Equation 16-20. The hydraulic head shall be based on hydraulic test data or hydraulic calculations assuming a flow rate corresponding to a rainfall intensity equal to or greater than the 15-minute duration storm with return period given in Table 1611.1. Rainfall intensity shall be determined in inches per hour for 15-minute duration storms for the risk categories given in Table 1611.1. The ponding head shall be based on structural analysis as the depth of water due to deflections of the roof subjected to unfactored rain load and unfactored dead load.

Equation 16-20 $R = 5.2(d_s + d_h + d_p)$

For SI: $R = 0.0098(d_s + d_h + d_p)$

where:

d_h = Hydraulic head equal to the depth of water on the undeflected roof above the inlet of the secondary drainage system for structural loading (SDSL) required to achieve the design flow, in inches (mm).

d_p = Ponding head equal to the depth of water due to deflections of the roof subjected to unfactored rain load and unfactored dead load, in inches (mm).

d_s = Static head equal to the depth of water on the undeflected roof up to the inlet of the secondary drainage system for structural loading (SDSL), in inches (mm).

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R = Rain load, in pounds per square foot (kN/m^2).

SDSL is the roof drainage system through which water is drained from the roof when the drainage systems listed in ASCE 7 Section 8.2 (a) through (d) are blocked or not working.

TABLE 1611.1—DESIGN STORM RETURN PERIOD BY RISK CATEGORY	
RISK CATEGORY	**DESIGN STORM RETURN PERIOD**
I & II	100 years
III	200 years
IV	500 years

1611.2 Ponding instability. Ponding instability on roofs shall be evaluated in accordance with ASCE 7.

1611.3 Controlled drainage. Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611.1. Such roofs shall be checked for ponding instability in accordance with Section 1611.2.

SECTION 1612—FLOOD LOADS

1612.1 General. Within flood hazard areas as established in Section 1612.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

1612.2 Design and construction. The design and construction of buildings and structures located in flood hazard areas, including coastal high hazard areas and coastal A zones, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24. Elevators, escalators, conveying systems and their components shall conform to ASCE 24 and ASME A17.1/CSA B44 as applicable.

Exception: Temporary structures complying with Section 3103.6.1.3.

1612.3 Establishment of flood hazard areas. To establish flood hazard areas, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency in an engineering report entitled "The Flood Insurance Study for **[INSERT NAME OF JURISDICTION]**," dated **[INSERT DATE OF ISSUANCE]**, as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

Exception: [OSHPD 1R, 2 & 5] *The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency's Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located.*

1612.3.1 Design flood elevations. Where design flood elevations are not included in the flood hazard areas established in Section 1612.3, or where floodways are not designated, the building official is authorized to require the applicant to do one of the following:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source.
2. Determine the design flood elevation or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

1612.3.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

1612.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas other than coastal high hazard areas or coastal A zones:
    1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.
    1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

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1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24 and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.

1.4. For dry floodproofed nonresidential buildings, the elevation to which the building is dry floodproofed as required for the final inspection in Section 110.3.12.1.

2. For construction in coastal high hazard areas and coastal A zones:

2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.

2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.

2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m^2) determined using allowable stress design or a resistance to an ultimate load of more than 33 pounds per square foot (1.58 kN/m^2), construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

2.4 For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

SECTION 1613—EARTHQUAKE LOADS

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The seismic design category for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to Seismic Design Category A, B or C.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD, see Section 2308.*
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.
6. Temporary structures complying with Section 3103.6.1.4.

1613.1.1 Scope. [SL] *For applications listed in Section 1.12 regulated by the State Librarian, only the provisions of ASCE 7 Tables 13.5-1 and 1607.1, as amended, of this code shall apply.*

1613.1.2 State-owned buildings. [BSC] *State-owned buildings, including those of the University of California, CSU and Judicial Council, shall not be constructed where any portion of the foundation would be within a mapped area of earthquake-induced liquefaction or landsliding or within 50 feet of a mapped fault rupture hazard as established by Section 1803.7.*

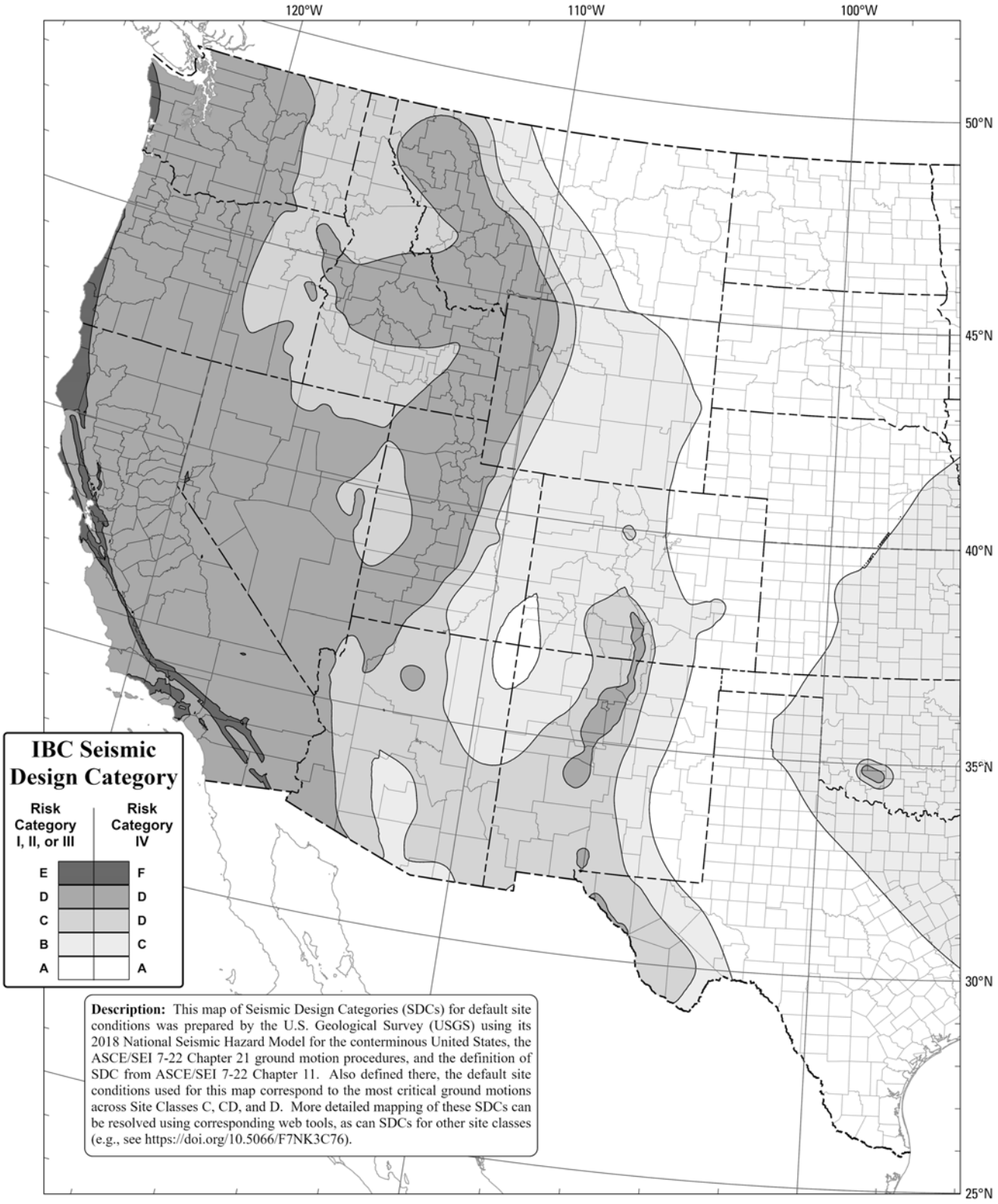
1613.1.3 Existing state buildings. [BSC] *Additions, alterations, repairs or change of occupancy category of existing buildings shall be in accordance with the California Existing Building Code, Part 10.*

1613.2 Determination of seismic design category. Structures shall be assigned to a seismic design category based on one of the following methods unless the authority having jurisdiction or geotechnical data determines that Site Class DE, E or F soils are present at the site:

1. Based on the structure risk category using Figure 1613.2(1).
2. Determined in accordance with ASCE 7.

Where Site Class DE, E or F soils are present, the seismic design category shall be determined in accordance with ASCE 7. ***[OSHPD 1R, 2 & 5]*** *Seismic design category shall be D or higher.*

FIGURE 1613.2(1)—SEISMIC DESIGN CATEGORIES FOR DEFAULT SITE CONDITIONS FOR THE CONTERMINOUS UNITED STATES (WESTERN)


120°W
110°W
100°W
50°N
45°N
40°N
35°N
30°N
25°N
IBC Seismic Design Category
Risk Category I, II, or III
Risk Category IV
E
D
C
B
A
F
D
D
C
A
Description: This map of Seismic Design Categories (SDCs) for default site conditions was prepared by the U.S. Geological Survey (USGS) using its 2018 National Seismic Hazard Model for the conterminous United States, the ASCE/SEI 7-22 Chapter 21 ground motion procedures, and the definition of SDC from ASCE/SEI 7-22 Chapter 11. Also defined there, the default site conditions used for this map correspond to the most critical ground motions across Site Classes C, CD, and D. More detailed mapping of these SDCs can be resolved using corresponding web tools, as can SDCs for other site classes (e.g., see https://doi.org/10.5066/F7NK3C76).

1613.3 Simplified design procedure. Where the alternate simplified design procedure of ASCE 7 is used, the seismic design category shall be determined in accordance with ASCE 7.

1613.4 Ballasted photovoltaic panel systems. Ballasted, roof-mounted photovoltaic panel systems need not be rigidly attached to the roof or supporting structure. Ballasted, unattached PV panel systems shall be designed and installed only on roofs with slopes not more than 1 unit vertical in 12 units horizontal. Ballasted, unattached PV panel systems shall be designed to accommodate sliding in accordance with ASCE 7 Chapter 13. ***[OSHPD 1R, 2 & 5]*** *Ballasted photovoltaic panel systems shall be considered as an alternative system.*

1613.5 Elevators, escalators and other conveying systems. Elevators, escalators and other conveying systems and their components shall satisfy the seismic requirements of ASCE 7 and ASME A17.1/CSA B44 as applicable.

1613.6 Automatic sprinkler systems. Where required, automatic sprinkler systems, including anchorage and bracing, shall comply with ASCE 7 and Section 903.3.1.1.

1613.7 Component importance factors. [OSHPD 1R, 2 & 5] *Nonstructural components designated below shall have a component importance factor, I_p, equal to 1.5:*

1. *For components that are required for life-safety purposes after an earthquake, including emergency and standby power systems, mechanical smoke removal systems, fire protection sprinkler systems and fire alarm control panels.*
2. *For medical equipment required for patient life support.*

SECTION 1614—ATMOSPHERIC ICE LOADS

1614.1 General. Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

Exception: Temporary structures complying with Section 3103.6.1.5.

SECTION 1615—TSUNAMI LOADS

1615.1 General. The design and construction of Risk Category III and IV buildings and structures located in the Tsunami Design Zones defined in the Tsunami Design Geodatabase shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code.

Exception: Temporary structures complying with Section 3103.6.1.6.

SECTION 1616—STRUCTURAL INTEGRITY

1616.1 General. High-rise buildings that are assigned to Risk Category III or IV shall comply with the requirements of Section 1616.2 if they are frame structures, or Section 1616.3 if they are bearing wall structures.

1616.2 Frame structures. Frame structures shall comply with the requirements of this section.

1616.2.1 Concrete frame structures. Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of Section 4.10 of ACI 318. Where ACI 318 requires that nonprestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

Exception: Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

1616.2.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures. Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

1616.2.2.1 Columns. Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

1616.2.2.2 Beams. End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for allowable stress design (ASD) or two-thirds of the required shear strength for load and resistance factor design (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

Exception: Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than $^3/_8$-inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two orthogonal directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for LRFD, but not less than 10 kips (45 kN).

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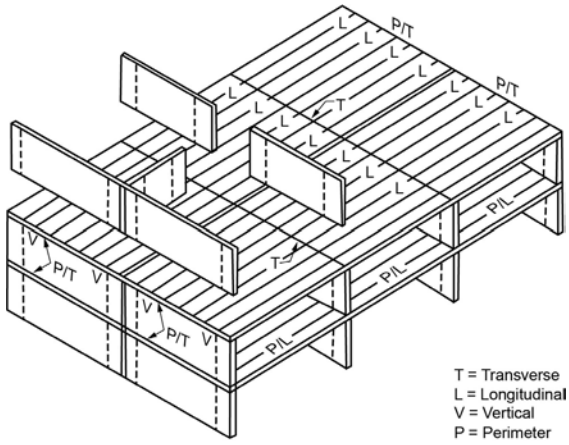
1616.3 Bearing wall structures. Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1616.3.

FIGURE 1616.3—LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES



1616.3.1 Concrete wall structures. Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 16.2.4 and 16.2.5 of ACI 318.

1616.3.2 Other bearing wall structures. Ties in bearing wall structures other than those covered in Section 1616.3.1 shall conform to this section.

1616.3.2.1 Longitudinal ties. Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength, T_T, given by Equation 16-21. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

Equation 16-21 $T_T = w\,LS \le \alpha_T S$

where:

L = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).

w = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m^2).

S = The spacing between ties, feet (m).

α_T = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.

1616.3.2.2 Transverse ties. Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed not farther apart than the spacing of load-bearing walls. Transverse ties shall have minimum nominal tensile strength T_T, given by Equation 16-21. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

1616.3.2.3 Perimeter ties. Perimeter ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than T_p, given by Equation 16-22. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

Equation 16-22 $T_p = 200w \le \beta_T$

For SI: $T_p = 90.7w \le \beta_T$

where:

w = As defined in Section 1616.3.2.1.

β_T = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing walls and a value of 4,000 pounds (1300 kN) for structures with bearing walls of cold-formed steel light-frame construction.

1616.3.2.4 Vertical ties. Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that story plus the weight of the diaphragm tributary to the wall in the story below. Not fewer than two ties shall be provided for each

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wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

SECTION 1617—ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

1617.1 Construction documents.

1617.1.1 *Additional requirements for construction documents are included in Sections 4-210 and 4-317 of the California Administrative Code (Part 1, Title 24, C.C.R).*

1617.1.2 Connections. *Connections that resist design seismic forces shall be designed and detailed on the design drawings.*

1617.1.3 Construction procedures. *Where unusual erection or construction procedures are considered essential by the project structural engineer or architect in order to accomplish the intent of the design or influence the construction, such procedure shall be indicated on the plans or in the specifications.*

1617.2 General design requirements.

1617.2.1 Lateral load deflections.

1617.2.1.1 Horizontal diaphragms. *The maximum span-depth ratio for any roof or floor diaphragm consisting of steel and composite steel slab decking or concrete shall be based on test data and design calculations acceptable to the enforcement agency.*

1617.2.1.2 Veneers. *The deflection shall not exceed l/600 for veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing.*

>

1617.2.2 Risk Category of buildings and other structures. *Risk Category IV includes structures as defined in the California Administrative Code, Section 4-207 and all structures required for their continuous operation or access/egress.*

1617.2.3 Structural walls*. For anchorage of concrete or masonry walls to roof and floor diaphragms, the out-of-plane strength design force shall not be less than 280 lb/linear ft (4.09 kN/m) of wall.*

1617.2.4 Photovoltaic (PV) panel systems. *The risk category for elevated PV support structures shall not be less than the risk category that corresponds to the usable space underneath in accordance with the risk category and nature of occupancy descriptions in Table 1604.5 and Section 1617.2.2.*

1617.3 Load combinations.

1617.3.1 Stability. *When checking stability under the provisions of Section 1605.1.1 using allowable stress design, the factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported.*

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1617.3.2 Alternative allowable stress design load combinations. *Where the alternative allowable stress design load combinations of Section 1605.2 are used, each load combination shall be investigated with one or more of the variable loads set to zero.*

1617.3.3 Modifications to load combinations in ICC 300. *Modify the text of ICC 300 as follows:*

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1617.3.3.1 ICC 300, Section 303.5.3. *Modify Section 303.5.3 as follows:*

The uniform live load, L, used in Equations 3-4 and 3-9 shall be permitted to be taken as zero when evaluating elements supporting the handrail/guardrail provided those elements do not also support L.

1617.4 Roof dead loads. *The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is permitted to be applied over the original roofing without its removal, in accordance with Section 1512.*

1617.5 Live loads.

1617.5.1 Modifications to Table 1607.1.

1617.5.1.1 Item 4. Assembly areas. *The following minimum loads for stage accessories apply:*

1. *Gridirons and fly galleries: 75 pounds per square foot uniform live load.*
2. *Loft block wells: 250 pounds per lineal foot vertical load and lateral load.*
3. *Head block wells and sheave beams: 250 pounds per lineal foot vertical load and lateral load. Head block wells and sheave beams shall be designed for all tributary loft block well loads. Sheave blocks shall be designed with a safety factor of five.*
4. *Scenery beams where there is no gridiron: 300 pounds per lineal foot vertical load and lateral load.*
5. *Ceiling framing over stages shall be designed for a uniform live load of 20 pounds per square foot. For members supporting a tributary area of 200 square feet or more, this additional load may be reduced to 15 pounds per square foot (0.72 kN/m^2).*

1617.5.1.2 Reserved.

1617.5.1.3 Item 4. Bleachers, folding and telescopic seating and grandstands. *The minimum uniform live load for a press box floor or accessible roof with railing is 100 psf.*

1617.5.1.4 Item 38. Yards and terraces, pedestrians. *Item 38 applies to pedestrian bridges and walkways that are not subjected to uncontrolled vehicle access.*

1617.5.1.5 Item 39. Storage racks and wall-hung cabinets. *The minimum vertical design live load shall be as follows:*

Paper media:

12-inch-deep (305 mm) shelf - 33 pounds per lineal foot (482 N/m)

15-inch-deep (381 mm) shelf - 41 pounds per lineal foot (598 N/m), or 33 pounds per cubic foot (5183 N/m^3) per total volume of the rack or cabinet, whichever is less.

Film media:

18-inch-deep (457 mm) shelf - 100 pounds per lineal foot (1459 N/m), or

50 pounds per cubic foot (7853 N/m^3) per total volume of the rack or cabinet, whichever is less.

Other media:

20 pounds per cubic foot (311 N/m^3) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

1617.5.2 Uncovered open-frame roof structures. *Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m^2) of the total area encompassed by the framework.*

1617.5.3 Seating for assembly uses. *Replace Section 1607.18 with the following:*

Bleachers, folding and telescopic seating and grandstands shall be designed for the loads specified in ICC 300 as modified by Section 1617.3.3 load combinations. Stadiums and arenas with fixed seats shall be designed for the horizontal sway loads in Section 1607.18.1.

1617.6 Determination of snow loads. *The ground snow load or the design snow load for roofs shall conform with the adopted ordinance of the city, county, or city and county in which the project site is located, and shall be approved by DSA. See Section 106.1.2 for snow load posting requirements.*

1617.7 Wind loads.

1617.7.1 Story drift for wind loads. *The calculated story drift due to wind pressures with ultimate design wind speed, V_{ult}, shall not exceed 0.008 times the story height for buildings less than 65 feet (19 812 mm) in height or 0.007 times the story height for buildings 65 feet (19 812 mm) or greater in height.*

Exception: *This story drift limit need not be applied for single-story open structures in Risk Categories I and II.*

1617.8 Soil loads.

1617.8.1 Lateral pressures. *Structures below grade shall be designed to resist lateral soil loads from adjacent soil in accordance with Sections 1807A.1.1 and 1807A.2.2, respectively.*

Note: *Sections 1807A.1.1 and 1807A.2.2 require the foundation and retaining walls be designed using the lateral soil loads determined by a geotechnical investigation in accordance with Section 1803A. Section 1807A.2.2 requires that design lateral soil load be at least 80 percent of the design lateral soil loads in accordance with Table 1610.1.*

1617.9 Flood loads.

1617.9.1 Establishment of flood hazard areas. *Flood hazard maps shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency's Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located, as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto.*

1617.10 Earthquake loads.

1617.10.1 Determination of seismic design category. *The seismic design category for a structure shall be determined in accordance with Section 1613.2. Seismic design category shall be D or higher.*

1617.10.2 Simplified design procedure. *The simplified design procedure of Section 1613.3 is not permitted by DSA-SS/CC.*

1617.10.3 Ballasted photovoltaic panel systems. *Ballasted, roof-mounted photovoltaic panel systems shall comply with ASCE 7, Section 13.6.12.*

1617.11 Tsunami loads. *The design and construction of Risk Category III or IV buildings and structures located in the ASCE Tsunami Design Zones defined in the ASCE Tsunami Design Geodatabase, or other data determined applicable by the enforcement agency, shall be in accordance with Section 1615.1 except as modified by this code. Tsunami Risk Category for community college buildings and structures shall be identified and submitted for acceptance by DSA. Determination of Tsunami Risk Category shall be proposed by the design professional in general responsible charge in coordination with the owner and local community based upon the relative importance of that facility to provide vital services, provide important functions and protect special populations. The determination of relative importance shall include consideration of a tsunami warning and evacuation plan and procedure when adopted by the local community.*

1617.12 Modifications to ASCE 7. *The text of ASCE 7 shall be modified as indicated in Sections 1617.12.1 through 1617.12.19.*

1617.12.1 ASCE 7, Section 1.3. *Modify ASCE 7, Section 1.3 by adding Section 1.3.8 as follows:*

1.3.8 Structural design criteria. *Where design is based on ASCE 7, Chapters 16, 17, 18 or 31, the seismic ground motion, wind tunnel test based design recommendations, analysis and design methods, material assumptions, testing requirements and acceptance criteria shall be submitted to the enforcement agency as an alternative system.*

Peer review requirements in Section 322 of the California Existing Buildings Code shall apply to design reviews required by ASCE 7, Chapters 17, 18, 31 and ASCE 49.

1617.12.2 ASCE 7, Table 12.2-1. *Modify ASCE 7, Table 12.2-1 as follows:*

A. BEARING WALL SYSTEMS

18. Light-framed walls with shear panels of all other materials—*Not permitted by DSA-SS/CC.*

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B. BUILDING FRAME SYSTEMS

25. Light-framed walls with shear panels of all other materials—*Not permitted by DSA-SS/CC.*

C. MOMENT RESISTING FRAME SYSTEMS

12. Cold-formed steel — special bolted moment frame—*Not permitted by DSA-SS/CC.*

Exceptions:

1. *Systems listed in this section can be used as an alternative system when pre-approved by the enforcement agency.*
2. *Rooftop or other supported structures not exceeding two stories in height and 10 percent of the total structure weight can use the systems in this section when designed as components per ASCE 7, Chapter 13.*
3. *Systems listed in this section can be used for seismically isolated buildings when permitted by ASCE 7, Section 17.2.5.4.*

1617.12.3 ASCE 7, Section 12.2.5.6.1. *The exception in Item a is not permitted by DSA-SS/CC.*

1617.12.4 ASCE 7, Section 12.2.5.7.1. *The exception in Item a is not permitted by DSA-SS/CC.*

1617.12.5 ASCE 7, Section 12.2.5.7.2. *The exception in Item a is not permitted by DSA-SS/CC.*

1617.12.6 ASCE 7, Section 12.3.3.1. *Replace ASCE 7, Section 12.3.3.1 by the following:*

12.3.3.1 Prohibited vertical irregularities for Seismic Design Categories *D through F.* Structures assigned to Seismic Design Category E or F that have vertical irregularities Type 1b, 4a or 4b of Table 12.3-2 shall not be permitted. *Structures assigned to Seismic Design Category D having vertical irregularity Type 1b or 4b of Table 12.3-2 shall not be permitted.*

Exception: Structures assigned to Seismic Design Category E or F that have vertical irregularity Type 4a shall be permitted where the story lateral strength is not less than 80 percent of that in the story above.

1617.12.7 ASCE 7, Section 12.7.2. *Modify ASCE 7, Section 12.7.2 by adding Item 7 to read as follows:*

7. *Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a Geotechnical engineer qualified in soils engineering, plus the difference in earth pressures shall be added to the lateral forces provided in this section.*

1617.12.8 ASCE 7, Section 12.10.2.1. *Replace Exception to ASCE 7, Section 12.10.2.1 by the following:*

Exception: In *light-frame* structures or portions thereof braced entirely by wood light-frame shear walls, collector elements and their connections, including connections to vertical elements, need only be designed to resist forces using the load combinations of Section 2.3.6 with seismic forces determined in accordance with Section 12.10.1.1.

1617.12.9 ASCE 7, Section 12.13.1. *Modify ASCE 7, Section 12.13.1 by adding Section 12.13.1.1 as follows:*

12.13.1.1 Foundations and superstructure-to-foundation connections. *The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil. Stability against overturning and sliding shall be in accordance with Section 1605.1.1.*

In addition, the foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. *The strength of the superstructure elements.*
2. *The maximum forces that can be delivered to the foundation in a fully yielded structural system.*
3. *Forces from the Load Combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3.1.*

Exceptions:

1. *Where referenced standards specify the use of higher design loads.*
2. *When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.*
3. *Where seismic force-resisting system consists of light-framed walls with shear panels, unless the reference standard specifies the use of higher design loads.*

Where the computation of the seismic overturning moment is by the equivalent lateral-force method or the modal analysis method, reduction in overturning moment permitted by Section 12.13.4 of ASCE 7 may be used.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

1617.12.10 ASCE 7, Section 12.13.5.2. *Modify ASCE 7, Section 12.13.5.2 by the following:*

Replace last sentence by the following: When vertical nominal strength (upward or downward) is determined by approved in-situ prototype testing program, resistance factor (ϕ) shall be permitted to be 0.75 (ϕ= 0.75).

1617.12.11 ASCE 7, Section 12.13.9.2. *Modify ASCE 7, Section 12.13.9.2 by adding the following sentence at the end of the exception:*

Seismic load effects determined in accordance with Section 12.4 need not be considered in this check.

1617.12.12 ASCE 7, Section 13.1.4. *Replace ASCE 7, Section 13.1.4 with the following:*

13.1.4 Nonstructural component and equipment support and attachment requirements: *The following nonstructural components and equipment shall be anchored in accordance with this section. Design and detailing shall be in accordance with Chapter 13 except as modified by this section.*

1. ***Fixed Equipment:*** *Equipment shall be anchored if it is directly attached to the building utility services such as electricity, gas or water. For the purposes of this requirement, "directly attached" shall include all electrical connections except plugs for 110/220-volt receptacles having a flexible cable/cord. Equipment that is connected to the building plumbing system with a shut-off valve in proximity to the equipment shall not be considered as directly attached provided the inside diameter of the pipe/tubing is less than $^1/_2$ inch (12.7 mm).*
2. ***Movable Equipment:*** *Equipment is subject to the same requirement as fixed equipment, but is permitted to be anchored by re-attachable anchors or restraints in a manner approved by the enforcement agency. Utilities and services at the equipment shall have flexible connections to allow for necessary movement.*
3. ***Mobile Equipment:*** *Equipment heavier than 400 pounds (181.4 kg) or that has a center of mass located 4 feet (1219 mm) or more above the adjacent floor or roof level that directly supports the equipment shall be restrained in a manner approved by the enforcement agency. Mobile equipment shall be restrained when not in use and is stored, unless the equipment is stored in a storage room that does not house hazardous materials or any facility systems or fixed equipment that can be affected by mobile equipment lacking restraint.*
4. ***Countertop Equipment:*** *Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed or movable equipment, as applicable. Countertop equipment shall also be subject to the same requirements as mobile or other equipment if weight of equipment is greater than 100 pounds (45 kg) and has a center of mass located 4 feet (1219 mm) or more above the adjacent floor level or if equipment could fall and block a required means of egress.*
5. ***Other Equipment:*** *Equipment shall be anchored where any of the following apply:*
   a. *Weight of equipment is greater than 100 pounds (45 kg) and essential to operations for emergency preparedness, communications and operations centers and other facilities required for emergency response of state-owned essential services buildings as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.*
   b. *Could fall and block a required means of egress.*
   c. *Weight of equipment is greater than 400 pounds (181.4 kg) or center of mass is located greater than 4 feet (1219 mm) above the finished floor or roof level that directly supports the component.*
6. *Equipment with hazardous contents.*
7. *Other architectural, mechanical and electrical components stated in Chapter 13. Cabinets shall be restrained in a manner approved by the enforcement agency if they could fall and block a required means of egress.*
8. ***Wall-, Roof- or Floor-Hung Equipment:*** *Seismic design and seismic details shall be provided for wall-, roof- or floor-hung nonstructural components and equipment when the component weighs more than 20 pounds (9 kg) or, in the case of a distribution system, 5 pounds per foot (73 N/m).*

Exemptions: *The following nonstructural components are exempt from the requirements of ASCE 7, Chapter 13:*

1. *Furniture except storage cabinets as noted in Table 13.5-1.*
2. *Nonstructural components and equipment that are positively attached to the structure, provided that the component weighs 20 pounds (9 kg) or less.*
3. *Discrete architectural, mechanical and electrical components and equipment that are positively attached to the structure, provided that the component weighs 400 pounds (181.4 kg) or less, and the center of mass is located 4 feet (1219 mm) or less above the adjacent floor or roof level that directly supports the component, flexible connections are provided between the component and associated ductwork, piping and conduit where required, and the component importance factor, I_p, is equal to 1.0.*

1617.12.13 ASCE 7, Section 13.5.6.2. *Modify ASCE 7, Section 13.5.6.2 by the following exception added to the end of Section 13.5.6.2.2 and by adding Section 13.5.6.2.3 as follows:*

Exception to Section 13.5.8.1 shall not be used in accordance with ASTM E580 Section 5.5.

13.5.6.2.3 Modification to ASTM E580. *Modify ASTM E580 by the following:*

1. ***Exitways.*** *Lay-in ceiling assemblies in exitways of hospitals and essential services buildings shall be installed with a main runner or cross runner surrounding all sides of each piece of tile, board or panel and each light fixture or grille. A cross runner that supports another cross runner shall be considered as a main runner for the purpose of structural classification. Splices or intersections of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs or other approved connectors. Lateral force diagonal bracing may be omitted in the short or transverse direction of exitways, not exceeding 8 feet wide, when perimeter support in accordance with ASTM E580 Sections 5.2.2 and 5.2.3 is provided and the perimeter wall laterally supporting the ceiling in the short or transverse direction is designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces.*
2. ***Corridors and lobbies.*** *Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.*

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3. ***Lay-in panels.*** *Metal panels and panels weighing more than $^1/_2$ pounds per square foot (24 N/m^2) other than acoustical tiles shall be positively attached to the ceiling suspension runners.*
4. ***Lateral force bracing.*** *Lateral force bracing is required for all ceiling areas except that they shall be permitted to be omitted in rooms with floor areas up to 144 square feet when perimeter support in accordance with ASTM E580 Sections 5.2.2 and 5.2.3 are provided and perimeter walls are designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces. Horizontal restraint point spacing shall be justified by analysis or test and shall not exceed a spacing of 12 feet by 12 feet. Bracing wires shall be secured with four tight twists in $1^1/_2$ inches, or an approved alternate connection.*
5. *Ceiling support and bracing wires shall be spaced a minimum of 6 inches from all pipes, ducts, conduits and equipment that are not braced for horizontal forces, unless approved otherwise by the building official.*

1617.12.14 ASCE 7, Section 13.6.5. *Replace ASCE 7, Section 13.6.5 as follows:*

13.6.5 Distribution systems: Conduit, cable tray and raceways. Cable trays and raceways shall be designed for seismic forces and seismic relative displacements as required in Section 13.3. Conduit *equal to or* greater than 2.5 inches (64 mm) trade size and attached to panels, cabinets or other equipment subject to seismic relative displacement, D_{pl}, shall be provided with flexible connections or designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions:

1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for raceways where flexible connections or other assemblies are provided between the cable tray or raceway and associated components to accommodate the relative displacement, where the cable tray or raceway is positively attached to the structure, and where one of the following apply:
   a. Trapeze assemblies with $^3/_8$-inch (10 mm) or $^1/_2$-inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the conduit, cable tray, or raceway support point to the connection at the supporting structure are used to support the cable tray or raceway, and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or
   b. The conduit, cable tray or raceway is supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the raceway run is 12 inches (305 mm) or less in length from the conduit, cable tray or raceway support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.
2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for conduit, regardless of the value of I_p, where the conduit is less than 2.5 inches (64 mm) trade size.

Design for the displacements across seismic joints shall be required for conduit, cable trays and raceways with $I_p = 1.5$ without consideration of conduit size.

1617.12.15 ASCE 7, Section 13.6.6. *Replace ASCE 7, Section 13.6.6 with the following:*

13.6.6 Distribution Systems: Duct Systems. HVACR and other duct systems shall be designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions: The following exceptions pertain to *ductwork* not designed to carry toxic, highly toxic or flammable gases or not used for smoke control:

1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for duct systems where flexible connections or other assemblies are provided to accommodate the relative displacement between the duct system and associated components, the duct system is positively attached to the structure, and where one of the following apply:
   a. Trapeze assemblies with $^3/_8$-inch (10 mm) *or $^1/_2$-inch (13 mm)* diameter rod hangers not exceeding 12 inches (305 mm) in length from the duct support point to the connection at the supporting structure are used to support duct, and the total weight supported by any single trapeze is *less than 10 lb/ft (146 N/m) and* 100 pounds or less; or
   b. The duct is supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the duct run is 12 inches (305 mm) or less in length from the duct support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.
2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required where provisions are made to avoid impact with other ducts or mechanical components or to protect the ducts in the event of such impact, the distribution system is positively attached to the structure; and HVACR ducts have a cross-sectional area of less than 6 square feet (0.557 m^2) and weigh 20 lb/ft (292 N/m) or less.

Components that are installed in line with the duct system and have an operating weight greater than 75 pounds (334 N), such as fans, terminal units, heat exchangers and humidifiers, shall be supported and laterally braced independent of the duct system, and such braces shall meet the force requirements of Section 13.3.1. Components that are installed in line with the duct system, have an operating weight of 75 pounds (334 N) or less, such as small terminal units, dampers, louvers and diffusers, and are otherwise not independently braced shall be positively attached with mechanical fasteners to the rigid duct on both sides. Piping and conduit attached to in-line equipment shall be provided with adequate flexibility to accommodate the seismic relative displacements of Section 13.3.2.

1617.12.16 ASCE 7, Section 13.6.7.3. *Replace ASCE 7, Section 13.6.7.3 with the following:*

13.6.7.3 Additional provisions for piping and tubing systems.

A) Design for the seismic forces of Section 13.3 shall not be required for piping systems where flexible connections, expansion loops or other assemblies are provided to accommodate the relative displacement between component and piping, where the piping system is positively attached to the structure, and where any of the following conditions apply:

1. Trapeze assemblies are supported by $^{3}/_{8}$-inch (10 mm) or $^{1}/_{2}$-inch (13-mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the pipe support point to the connection at the supporting structure, and no single pipe exceeds the diameter limits set forth in item *2b or 2 inches (50 mm) where I_p is greater than 1.0* and the total weight supported by any single trapeze is 100 pounds (445 N) or less; *or*
2. Piping is supported by rod hangers and provisions are made to avoid impact with other structural or nonstructural components or to protect the piping in the event of such impact; or pipes are supported by individual rod hangers $^{3}/_{8}$ inch (10 mm) or $^{1}/_{2}$ inch (13 mm) in diameter, where each hanger in the pipe run is 12 inches (305 mm) or less in length from the pipe support point to the connection at the supporting structure, and the total weight supported by any single hanger is 50 pounds (220 N) or less. In addition, the following limitations on the size of piping shall be observed:
   a. In structures assigned to Seismic Design Category D, E or F where I_p is greater than 1.0, the nominal pipe size shall be 1 inch (25 mm) or less.
   b. In structures assigned to Seismic Design Category D, E or F where $I_p = 1.0$, the nominal pipe size shall be 3 inches (80 mm) or less.
3. Pneumatic tube systems supported with trapeze assemblies using $^{3}/_{8}$-inch (10 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the tube support point to the connection at the supporting structure and the total weight supported by any single trapeze is 100 pounds (445 N) or less.
4. Pneumatic tube systems supported by individual rod hangers $^{3}/_{8}$ inch (10 mm) or $^{1}/_{2}$ inch (13 mm) in diameter, and each hanger in the run is 12 inches (305 mm) or less in length from the tube support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

B) Flexible connections in piping required in Section 13.6.7.3 are not required where pipe is rigidly attached to the same floor or wall that provides vertical and lateral support for the equipment, or to a fixture.

C) Flexible connections in piping are required at seismic separation joints and shall be detailed to accommodate the seismic relative displacements at connections.

1617.12.17 ASCE 7, Section 13.6.11.1. *Modify ASCE 7, Section 13.6.11.1 by adding Section 13.6.11.1.1, as follows:*

13.6.11.1.1 Elevators guide rail support. *The design of guide rail support bracket fastenings and the supporting structural framing shall use the weight of the counterweight or maximum weight of the car plus not more than 40 percent of its rated load. The seismic forces shall be assumed to be distributed one-third to the top guiding members and two-thirds to the bottom guiding members of cars and counterweights, unless other substantiating data are provided. In addition to the requirements of ASCE 7, Section 13.6.11.1, the minimum seismic forces shall be 0.5g allowable stress design load acting in any horizontal direction.*

1617.12.18 ASCE 7, Section 13.6.11.4. *Replace ASCE 7, Section 13.6.11.4, as follows:*

13.6.11.4 Retainer plates. Retainer plates are required at the top and bottom of the car and counterweight, *except where safety devices acceptable to the enforcement agency are provided which meet all requirements of the retainer plates, including full engagement of the machined portion of the rail. The design of the car, cab stabilizers, counterweight guide rails and counterweight frames for seismic forces shall be based on the following requirements:*

1. *The seismic force shall be computed per the requirements of ASCE 7, Section 13.6.11.1. The minimum horizontal acceleration shall be 0.5g allowable stress design load for all buildings.*
2. *W_p shall equal the weight of the counterweight or the maximum weight of the car plus not less than 40 percent of its rated load.*
3. *With the car or counterweight located in the most adverse position, the stress in the rail shall not exceed the limitations specified in these regulations, nor shall the deflection of the rail relative to its supports exceed the deflection listed below.*

RAIL SIZE (weight per foot of length, pounds)	*WIDTH OF MACHINED SURFACE (inches)*	*ALLOWABLE RAIL DEFLECTION (inches)*
8	*$1^{1}/_{4}$*	*0.20*
11	*$1^{1}/_{2}$*	*0.30*
12	*$1^{3}/_{4}$*	*0.40*
15	*$1^{31}/_{32}$*	*0.50*
$18^{1}/_{2}$	*$1^{31}/_{32}$*	*0.50*
$22^{1}/_{2}$	*2*	*0.50*
30	*$2^{1}/_{4}$*	*0.50*

For SI: 1 inch = 25 mm, 1 foot = 305 mm, 1 pound = 0.454 kg.

Note: Deflection limitations are given to maintain a consistent factor of safety against disengagement of retainer plates from the guide rails during an earthquake.

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4. *Where guide rails are continuous over supports and rail joints are within 2 feet (610 mm) of their supporting brackets, a simple span may be assumed.*
5. *The use of spreader brackets is allowed.*
6. *Cab stabilizers and counterweight frames shall be designed to withstand computed lateral load with a minimum horizontal acceleration of 0.5g allowable stress design load.*

1617.12.19 ASCE 7, Section 17.2.4.7. *Modify ASCE 7, Section 17.2.4.7 by adding the following to the end of the section:*

The effects of uplift shall be explicitly accounted for in the analysis and in the testing of the isolator units.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 16A – STRUCTURAL DESIGN

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter								**X**		**X**				**X**										
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below						**X**	**X**					**X**			**X**									
Chapter / Section																								
1607A.9.2						X	X																	
1617A.1.18												X			X									
1617A.1.41											X	X		†	X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

16A

STRUCTURAL DESIGN

User notes:

About this chapter: *Chapter 16A prescribes minimum structural loading requirements for use in the design and construction of structures regulated by the Division of the State Architect-Structural Safety—including public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Section 1.9.2.1 [DSA-SS])—and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development—including hospitals and correctional treatment centers (applications listed in Sections 1.10.1 [OSHPD 1] and 1.10.4 [OSHPD 4]).*

SECTION 1601*A*—GENERAL

1601*A*.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof.

1601A.1.1 Application. *The scope of application of Chapter 16A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Applications listed in Sections 1.10.1 and 1.10.4, regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD). These applications include hospitals and correctional treatment centers.*

1601A.1.2 Amendments in this chapter. *DSA-SS and OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:*

   [DSA-SS] – *For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Hospital Planning and Development:*

   [OSHPD 1] – *For applications listed in Section 1.10.1.*

   [OSHPD 4] – *For applications listed in Section 1.10.4.*

1601A.2 Enforcement agency approval. *In addition to the requirements of the California Administrative Code and the California Building Code, any aspect of project design, construction, quality assurance or quality control programs for which this code requires approval by the Registered Design Professional (RDP), are also subject to approval by the enforcement agency.*

SECTION 1602*A*—NOTATIONS

1602*A*.1 Notations. The following notations are used in this chapter:

D = Dead load.

D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.

E = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4 of ASCE 7.

F = Load due to fluids with well-defined pressures and maximum heights.

F_a = Flood load in accordance with Chapter 5 of ASCE 7.

H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

L = Live load.

L_r = Roof live load.

$p_{g(asd)}$ = Allowable stress design ground snow load.

p_g = Ground snow load determined from Figures 1608.2(1) through 1608.2(4) and Table 1608.2.

R = Rain load.

S = Snow load.

T = Cumulative effects of self-straining load forces and effects.

V_{asd} = Allowable stress design wind speed, mph (m/s) where applicable.

V = Basic wind speed, *V*, mph (m/s) determined from Figures 1609*A*.3(1) through 1609*A*.3(4) or ASCE 7.

V_T = Tornado speed, mph (m/s) determined from Chapter 32 of ASCE 7.

W = Load due to wind pressure.

W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

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SECTION 1603*A*—CONSTRUCTION DOCUMENTS

1603*A*.1 General. Construction documents shall show the material, size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603*A*.1.1 through *1603A.1.10* shall be indicated on the construction documents.

Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof dead and live loads.
2. Ground snow load, p_g, and allowable stress design ground snow load, $p_{g(asd)}$.
3. Basic wind speed, *V*, mph (m/s), and allowable stress design wind speed, V_{asd}, as determined in accordance with Section 1609*A*.3.1 and wind exposure.
4. Seismic design category and site class.
5. Flood design data, if located in flood hazard areas established in Section 1612*A*.3.
6. Design load-bearing values of soils.
7. Rain load data.

[DSA-SS] *Additional requirements are included in Section 4-210 and 4-317 of the California Administrative Code (Part 1, Title 24, C.C.R).*

[OSHPD 1] *Additional requirements are included in Section 7-115 and 7-125 of the California Administrative Code.*

1603*A*.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607*A*.13 shall be indicated for each type of live load used in the design.

1603*A*.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas.

1603*A*.1.3 Roof snow load data. The ground snow load, p_g, shall be indicated. In areas where the ground snow load, p_g, exceeds 15 pounds per square foot (psf) (0.72 kN/m^2), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load, p_f.
2. Snow exposure factor, C_e.
3. Risk category.
4. Thermal factor, C_t.
5. Slope factor(s), C_s.
6. Drift surcharge load(s), p_d, where the sum of p_d and p_f exceeds 30 psf (1.44 kN/m^2).
7. Width of snow drift(s), *w*.
8. Winter wind parameter for snow drift, W_2.

1603*A*.1.4 Wind and tornado design data. The following information related to wind loads and, where required by Section 1609*A*.5, tornado loads shall be shown, regardless of whether wind or tornado loads govern the design of the lateral force-resisting system of the structure:

1. Basic wind speed, *V*, mph (m/s), tornado speed, V_T, mph (m/s), and allowable stress design wind speed, V_{asd}, mph (m/s), as determined in accordance with Section 1609*A*.3.1.
2. Risk category.
3. Effective plan area, A_e, for tornado design in accordance with Chapter 32 of ASCE 7.
4. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
5. Applicable internal pressure coefficients, and applicable tornado internal pressure coefficients.
6. Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the registered design professional responsible for the design of the structure, pounds per square foot (kN/m^2). Where design for tornado loads is required, the design pressures shown shall be the maximum of wind or tornado pressures.

1603*A*.1.5 Earthquake design data. The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

1. Risk category.
2. Seismic importance factor, I_e.
3. Spectral response acceleration parameters, S_S and S_1.
4. Site class.
5. Design spectral response acceleration parameters, S_{DS} and S_{D1}.
6. Seismic design category.
7. Basic seismic force-resisting system(s).
8. Design base shear(s).
9. Seismic response coefficient(s), C_s.
10. Response modification coefficient(s), *R*.

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11. Analysis procedure used.
12. *Applicable horizontal structural irregularities.*
13. *Applicable vertical structural irregularities.*
14. *Location of base as defined in ASCE 7, Section 11.2.*

1603A.1.5.1 Connections. *Connections that resist design seismic forces shall be designed and detailed on the design drawings.*

1603*A*.1.6 Geotechnical information. The design load-bearing values of soils shall be shown on the construction documents.

1603*A*.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612*A*.3, the documentation pertaining to design, if required in Section 1612*A*.4, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. Flood design class assigned according to ASCE 24.
2. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation of the proposed lowest floor, including the basement.
3. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation to which any nonresidential building will be dry floodproofed.
4. In coastal high hazard areas and coastal A zones, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1603*A*.1.8 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof, including but not limited to the loads of machinery or equipment, and that are greater than specified floor and roof loads shall be specified by their descriptions and locations.

1603*A*.1.8.1 Photovoltaic panel systems. The dead load of rooftop-mounted photovoltaic panel systems, including rack support systems, shall be indicated on the construction documents.

1603*A*.1.9 Roof rain load data. Design rainfall intensity, i (in/hr) (cm/hr), and roof drain, scupper and overflow locations shall be shown regardless of whether rain loads govern the design.

1603A.1.10 Construction procedures. *Where unusual erection or construction procedures are considered essential by the Registered Design Professional (RDP) in order to accomplish the intent of the design or influence the construction, such procedure shall be indicated on the construction documents.*

1603A.2 Site data reports. *Geotechnical and geohazard reports for review by the enforcement agency shall be accompanied by a description of the project prepared by the registered design professional (RDP) in responsible charge, which shall include the following:*

1. *Type of service such as general acute care facility, central utility plants, K-12 school, community college, essential services, etc.*
2. *Construction materials used for the project such as steel, concrete. masonry, wood, etc.*
3. *Type of construction project such as new, addition, alteration, repair, etc.*
4. *For existing buildings, extent of construction such as incidental, minor, major and/or voluntary seismic improvements as defined in Section 318, Part 10, Title 24, CCR **[DSA-SS]** Section 202 and California Existing Building Code Section 202A **[OSHPD 1]**.*
5. *Seismic force resisting system used for each structure in the project.*
6. *Foundation system that will be used for each structure in the project such as spread footing, drilled piers, etc.*
7. *Analysis procedure used and basis of design such as ASCE 7 Equivalent Lateral Force Procedure, ASCE 41 Nonlinear Dynamic Procedure, etc.*
8. *Building characteristics such as number of stories above and below grade, foot print area at grade, grade slope on site, etc.*
9. *Special features such as requirement for shoring, underpinning, retaining walls, etc.*

1603A.3 Structural design basis and calculations. *The application for the approval of construction documents that involves structural elements or components shall be accompanied by complete and accurate structural design computations, which shall comply with requirements prescribed by the enforcement agency:*

1. *The computations shall be preceded by a detailed index.*
2. *The computations including each major subsection shall be prefaced by a statement clearly and concisely outlining the basis for the structural design and indicating the manner in which the structure will resist the vertical loads and lateral forces.*
3. *The computations shall be sufficiently complete to the extent that calculations for the individual structural members and connections can be readily interpreted.*

SECTION 1604*A*—GENERAL DESIGN REQUIREMENTS

1604*A*.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters and referenced standards.

1604*A*.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction.

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Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604*A*.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604*A*.3.

TABLE 1604*A*.3—DEFLECTION LIMITS[a, b, c, h, i]

CONSTRUCTION	*L* or L_r	*E*, *S*[j] or *W*[f]	*D* + (*L* or L_r)[d, g]
Roof members:[e]			
Supporting plaster or stucco ceiling	*l*/360	*l*/360	*l*/240
Supporting nonplaster ceiling	*l*/240	*l*/240	*l*/180
Not supporting ceiling	*l*/180	*l*/180	*l*/120
Floor members	*l*/360	—	*l*/240
Exterior walls:			
With plaster or stucco finishes	—	*l*/360	—
With other brittle finishes	—	*l*/240	—
With flexible finishes	—	*l*/120	—
Veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing	—	*l/600*	—
Interior partitions:[b]			
With plaster or stucco finishes	*l*/360	—	—
With other brittle finishes	*l*/240	—	—
With flexible finishes	*l*/120	—	—
Farm buildings	—	—	*l*/180
Greenhouses	—	—	*l*/120

For SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed *l*/60. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed *l*/150. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed *l*/90. For roofs, this exception only applies when the metal sheets have no roof covering.

b. Flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607*A*.16.

c. See Section 2403 for glass supports.

d. The deflection limit for the *D* + (*L* or L_r) load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For lumber, structural glued laminated timber, prefabricated wood I-joists and structural composite lumber members that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from 0.5*D*. For lumber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from *D*. The value of 0.5*D* shall not be used in combination with ANSI/AWC NDS provisions for long-term loading.

e. The preceding deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 8 of ASCE 7.

f. The wind load shall be permitted to be taken as 0.42 times the "component and cladding" loads or directly calculated using the 10-year mean return interval basic wind speed, *V*, for the purpose of determining deflection limits in Table 1604*A*.3. Where framing members support glass, the deflection limit therein shall not exceed that specified in Section 1604*A*.3.7

g. For steel structural members, the deflection due to creep component of long-term dead load shall be permitted to be taken as zero.

h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed *l*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *l*/175 for each glass lite or *l*/60 for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *l*/120.

i. *l* = Length of the member between supports. For cantilever members, *l* shall be taken as twice the length of the cantilever.

j. The snow load shall be permitted to be taken as 0.7 times the design snow load determined in accordance with Section 1608*A*.1 for the purpose of determining deflection limits in Table 1604*A*.3.

1604*A*.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604*A*.3.2 through *1604A.3.9* or that permitted by Table 1604*A*.3.

1604*A*.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604*A*.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI 100 or SJI 200, as applicable.

1604*A*.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by TMS 402.

1604*A*.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM.

1604*A*.3.6 Limits. The deflection limits of Section 1604*A*.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

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1604*A*.3.7 Framing supporting glass. The deflection of framing members supporting glass subjected to 0.6 times the "component and cladding" wind loads shall not exceed either of the following:

1. $^1/_{175}$ of the length of span of the framing member, for framing members having a length not more than 13 feet 6 inches (4115 mm).
2. $^1/_{240}$ of the length of span of the framing member + $^1/_4$ inch (6.4 mm), for framing members having a length greater than 13 feet 6 inches (4115 mm).

1604A.3.8 Horizontal diaphragms. *The maximum span-depth ratio for any roof or floor diaphragm consisting of steel and composite steel slab decking shall not exceed those given in Table 1604A.4, unless test data and design calculations acceptable to the enforcement agency are submitted and approved for the use of other span-depth ratios. Concrete diaphragms shall not exceed the span depth ratios for the equivalent composite steel-slab diaphragm in Table 1604A.4.*

TABLE 1604A.4-MAXIMUM HORIZONTAL DIAPHRAGM SPAN AND SPAN-DEPTH RATIOS [1, 3, 4]

FLEXIBILITY FACTOR(F)[2]	MAXIMUM DIAPHRAGM SPAN FOR MASONRY OR CONCRETE WALLS (feet)	DIAPHRAGM SPAN-DEPTH LIMITATION			
		Rotation (torsion) Not Considered in Diaphragm		Rotation (torsion) Considered in Diaphragm	
		Masonry or Concrete Walls	Flexible Walls	Masonry or Concrete Walls	Flexible Walls
More than 150	Not to be used	Not to be used	2:1	Not to be used	$1^1/_2$:1
70–150	200	2:1 or as required for deflection	3:1	Not to be used	2:1
10–70	400	$2^1/_2$:1 or as required for deflection	4:1	As required for deflection	$2^1/_2$:1
1–10	No limitation	3:1 or as required for deflection	5:1	As required for deflection	3:1
Less than 1	No limitation	As required for deflection	No limitation	As required for deflection	$3^1/_2$:1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.594 N/m, 1 psi = 6894 Pa

1. *Diaphragms shall satisfy span-depth limitations based on flexibility.*
2. *Flexibility factor (F) is the average deflection in micro inches (10^{-6}) or μm of the diaphragm web per foot (m) of span stressed with a shear of 1 pound per foot (N/m).*
3. *The total deflection Δ of the diaphragm may be computed from the equation: $\Delta = \Delta_f + \Delta_w$.*

Where:

Δ_f = Flexural deflection of the diaphragm determined in the same manner as the deflection of beams. The flexural stiffness of the web of diaphragms consisting of bare steel decking shall be neglected.

Δ_w = Web deflection of the diaphragm may be determined solving the following equation:

$$F = \frac{\Delta_w x 10^6}{q_{ave} L}$$

Where:

L = Distance in feet (m) between the vertical resisting element (such as a shear wall) and the point to which the deflection is to be determined.

q_{ave} = Average shear in the diaphragm in pounds per foot (N/m) over length L.

4. *When applying these limitations to cantilevered diaphragms, the allowable span-depth ratio will be half of that shown.*

1604A.3.9 Deflections. *Deflection criteria for materials not specified shall be developed by the project architect or structural engineer in a manner consistent with the provisions of this section and approved by the enforcement agency.*

1604*A*.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the effects of added deformations expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided that their effect on the action of the system is considered and provided for in the design. Where a diaphragm is not permitted to be idealized as either flexible or rigid in accordance with ASCE 7 or for wood diaphragms in accordance with AWC SDPWS, the structure shall be analyzed and designed utilizing one of the following procedures:

1. An envelope analysis of the structure using a flexible and rigid diaphragm analysis separately and designing each component for the more severe load condition.
2. A semirigid diaphragm analysis and design.

Where required by ASCE 7, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

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Every structure shall be designed to resist the effects caused by the forces specified in this chapter, including overturning, uplift and sliding. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604*A*.5 Risk category. Each building and structure shall be assigned a risk category in accordance with Table 1604*A*.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein. Where a referenced standard specifies that the assignment of a risk category be in accordance with ASCE 7, Table 1.5-1, Table 1604*A*.5 shall be used in lieu of ASCE 7, Table 1.5-1.

Exceptions:

1. The assignment of buildings and structures to Tsunami Risk Categories III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.
2. Freestanding parking garages not used for the storage of emergency services vehicles or not providing means of egress for buildings or structures assigned to a higher risk category shall be assigned to Risk Category II.

TABLE 1604*A*.5—RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. • Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-3, Condition 1 occupancies. • Any other occupancy with an occupant load greater than 5,000.[a] • Power-generating stations with individual power units rated 75 MW_{AC} (megawatts, alternating current) or greater, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: • Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *California Fire Code*; and • Are sufficient to pose a threat to the public if released.[b]
IV	Buildings and other structures designated as essential facilities and buildings where loss of function represents a substantial hazard to occupants or users, including but not limited to: • ***[OSHPD 1 & 4]*** *General Acute-care Hospital Buildings, General Acute-care Hospital Buildings providing only acute medical rehabilitation center services, and Correctional Treatment Center Buildings and all structures required for their continuous operation or access/egress.* • Group I-2 occupancies. • Ambulatory care facilities having emergency surgery or emergency treatment facilities. • Group I-3 occupancies other than Condition 1. • Fire, rescue, ambulance and police stations and emergency vehicle garages • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response ***[DSA-SS]*** *as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.* • Public utility facilities providing power generation, potable water treatment, or wastewater treatment. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: • Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *California Fire Code*; and • Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load. The floor area for vehicular drive aisles shall be permitted to be excluded in the determination of net floor area in parking garages.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

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1604*A*.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety systems, designated seismic systems, emergency power systems, or emergency and egress lighting systems with another portion having a higher risk category, or provides required electrical, communications, mechanical, plumbing or conveying support to another portion assigned to Risk Category IV, both portions shall be assigned to the higher risk category.

Exception: Where a storm shelter designed and constructed in accordance with ICC 500 is provided in a building, structure or portion thereof normally occupied for other purposes, the risk category for the normal occupancy of the building shall apply unless the storm shelter is a designated emergency shelter in accordance with Table 1604*A*.5.

1604*A*.5.2 Photovoltaic (PV) panel systems. Photovoltaic (PV) panel systems and elevated PV support structures shall be assigned a risk category as follows:

1. Ground-mounted PV panel systems serving only Group R-3 buildings shall be assigned to Risk Category I.
2. Ground-mounted PV panel systems other than those described in Items 1 and 5 shall be assigned to Risk Category II.
3. Elevated PV support structures other than those described in Items 4, 5 and 6 shall be assigned to Risk Category II. ***[DSA-SS]*** *The risk category shall not be less than the risk category that corresponds to the usable space underneath in accordance with the risk category and nature of occupancy descriptions in Table 1604A.5.*
4. Rooftop-mounted PV panel systems and elevated PV support structures installed on top of buildings shall be assigned to the same risk category as the risk category of the building on which they are mounted.
5. PV panel systems and elevated PV support structures paired with energy storage systems (ESS) and serving as a dedicated, stand-alone source of backup power for Risk Category IV buildings shall be assigned to Risk Category IV.
6. Elevated PV support structures where the usable space underneath is used for parking of emergency vehicles shall be assigned to Risk Category IV.

1604*A*.6 In-situ load tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1708*A*.

1604*A*.7 Preconstruction load tests. Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable referenced standards, or alternative test procedures in accordance with Section 1707*A*, shall be load tested in accordance with Section 1709*A*.

1604*A*.8 Anchorage. Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604*A*.8.1 through 1604*A*.8.3, as applicable.

1604*A*.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

1604*A*.8.2 Structural walls. Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces that result from the application of the prescribed loads. The required earthquake out-of-plane loads are specified in Section 1.4.4 of ASCE 7 for walls of structures assigned to Seismic Design Category A and to Section 12.11 of ASCE 7 for walls of structures assigned to all other seismic design categories. *For anchorage of concrete or masonry walls to roof and floor diaphragms, the out-of-plane strength design force shall not be less than 280 lb/linear ft (4.09 kN/m) of wall.* Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements and 1613*A* for earthquake design requirements.

1604*A*.8.3 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. Connections of decks with cantilevered framing members to exterior walls or other framing members shall be designed for both of the following:

1. The reactions resulting from the dead load and live load specified in Table 1607*A*.1, or the snow load specified in Section 1608, in accordance with Section 1605*A*, acting on all portions of the deck.
2. The reactions resulting from the dead load and live load specified in Table 1607*A*.1, or the snow load specified in Section 1608*A*, in accordance with Section 1605*A*, acting on the cantilevered portion of the deck, and no live load or snow load on the remaining portion of the deck.

1604*A*.9 Wind and seismic detailing. Lateral force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7 Chapters 11, 12, 13, 15, 17 and 18 as applicable, even where wind load effects are greater than seismic load effects.

Exception: References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.

1604*A*.10 Loads on storm shelters. Loads and load combinations on storm shelters shall be determined in accordance with ICC 500.

SECTION 1605*A*—LOAD COMBINATIONS

1605*A*.1 General. Buildings and other structures and portions thereof shall be designed to resist the strength load combinations specified in ASCE 7, Section 2.3, the allowable stress design load combinations specified in ASCE 7, Section 2.4, or the alternative allowable stress design load combinations of Section 1605*A*.2.

Exceptions:

1. The modifications to load combinations of ASCE 7, Section 2.3, ASCE 7, Section 2.4 and Section 1605*A*.2 specified in ASCE 7 Chapters 18 and 19 shall apply.
2. Where the allowable stress design load combinations of ASCE 7, Section 2.4 are used, flat roof snow loads of 45 pounds per square foot (2.15 kN/m^2) and roof live loads of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic load. Where flat roof snow loads exceed 45 pounds per square foot (2.15 kN/m^2), 15 percent shall be combined with seismic loads.
3. Where the allowable stress design load combinations of ASCE 7 Section 2.4 are used, crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind loads.
4. Where design for tornado loads is required, the alternative allowable stress design load combinations of Section 1605*A*.2 shall not apply when tornado loads govern the design.

1605*A*.1.1 Stability. Regardless of which load combinations are used to design for strength, where overall structure stability (such as stability against overturning, sliding, or buoyancy) is being verified, use of the load combinations specified in Section 2.3 or 2.4 of ASCE 7, and in Section 1605*A*.2 shall be permitted. Where the load combinations specified in ASCE 7, Section 2.3 are used, strength reduction factors applicable to soil resistance shall be provided by a registered design professional. The stability of retaining walls shall be verified in accordance with Section 1807*A*.2.3. *When using allowable stress design, factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported.*

1605A.1.2 Foundation resistance. [OSHPD 1 & 4] *Strength design for foundation geotechnical capacity shall be in accordance with ASCE 7, Section 12.13.5 for all strength design load combinations, except that Resistance Factor (Ø) shall be permitted to be 1.0 for load combinations with amplified seismic forces in accordance with Section 1617A.1.15. Allowable stress design for foundation geotechnical capacity shall be in accordance with ASCE 7, Section 12.13.6 for all allowable stress design load combinations, and shall be established to be consistent with strength design requirements in ASCE 7, Section 12.13.5.*

1605*A*.2 Alternative allowable stress design load combinations. In lieu of the load combinations in ASCE 7, Section 2.4, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. Where using these alternative allowable stress load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. Where using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. Where using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect, E_v, in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero. Where required by ASCE 7, Chapters 12, 13 and 15, the load combinations including overstrength of ASCE 7, Section 2.4.5 shall be used. *Each load combination shall be investigated with one or more of the variable loads set to zero.*

Equation 16*A*-1 $D + L + (L_r \text{ or } 0.7S \text{ or } R)$

Equation 16*A*-2 $D + L + 0.6W$

Equation 16*A*-3 $D + L + 0.6W + 0.7S/2$

Equation 16*A*-4 $D + L + 0.7S + 0.6W/2$

Equation 16*A*-5 $D + L + 0.7S + E/1.4$

Equation 16*A*-6 $0.9D + E/1.4$

Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 45 pounds per square foot (2.15 kN/m^2) or less and roof live loads of 30 pounds per square foot (1.44 kN/m^2) or less need not be combined with seismic loads. Where flat roof snow loads exceed 45 pounds per square foot (2.15 kN/m^2), 15 percent shall be combined with seismic loads.

1605A.3 Modifications to load combinations in ICC 300. *Modify the text of ICC 300 as follows:*

1605A.3.1 ICC 300, Section 303.5.3. *Modify Section 303.5.3 as follows:*

The uniform live load L used in Equations 3-4 and 3-9 shall be permitted to be taken as zero when evaluating elements supporting the handrail/guard provided those elements do not also support L.

SECTION 1606*A*—DEAD LOADS

1606*A*.1 General. Buildings, structures, and parts thereof shall be designed to resist the effects of dead loads.

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1606*A*.2 Weights of materials of construction. For purposes of design, the actual weights of materials of construction shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

1606*A*.3 Weight of fixed service equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.
2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606*A*.4 Photovoltaic panel systems. The weight of photovoltaic panel systems, their support system, and ballast shall be considered as dead load.

1606*A*.5 Vegetative and landscaped roofs. The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as dead load. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe load effects on the structure.

1606A.6 Roof dead loads. *The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is permitted to be applied over the original roofing without its removal, in accordance with Section 1512.*

SECTION 1607*A*—LIVE LOADS

1607*A*.1 General. Buildings, structures, and parts thereof shall be designed to resist the effects of live loads.

TABLE 1607*A*.1—MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS

	OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
1.	Apartments (see residential)		—	—	—
2.	Access floor systems	Office use	50	2,000	—
		Computer use	100	2,000	—
3.	Armories and drill rooms		150[a]	—	—
4.	Assembly areas[c, e]	Fixed seats (fastened to floor)	60[a]	—	—
		Lobbies	100[a]		
		Movable seats	100[a]		
		Stage floors	150[a]		
		Platforms (assembly)	100[a]		
		Bleachers, folding and telescopic seating and grandstands[g]	100[a] (See Section 1607*A*.18)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60[a] (See Section 1607*A*.18)		
		Other assembly areas	100[a]		
5.	Balconies and decks		1.5 times the live load for the area served, not required to exceed 100	—	—
6.	Catwalks for maintenance and service access		40	300	—
7.	Cornices		60	—	—
8.	Corridors	First floor	100	—	—
		Other floors	Same as occupancy served except as indicated		
9.	Dining rooms and restaurants		100[a]	—	—
10.	Dwellings (see residential)		—	—	—
11.	Elevator machine room and control room grating (on area of 2 inches by 2 inches)		—	300	—
12.	Finish light floor plate construction (on area of 1 inch by 1 inch)		—	200	—

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TABLE 1607*A*.1—MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS—continued

	OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
13.	Fire escapes		100	—	—
		On single-family dwellings only	40		
14.	Fixed ladders		See Section 1607*A*.10		—
15.	Garages and vehicle floors	Passenger vehicle garages	40[c]	See Section 1607*A*.7	—
		Trucks and buses	See Section 1607*A*.8		
		Fire trucks and emergency vehicles	See Section 1607*A*.8		
		Forklifts and movable equipment	See Section 1607*A*.8		
16.	Handrails, guards and grab bars		See Section 1607*A*.9		—
17.	Helipads	Helicopter takeoff weight 3,000 pounds or less	40[a]	See Section 1607*A*.6.1	Section 1607*A*.6
		Helicopter takeoff weight more than 3,000 pounds	60[a]	See Section 1607*A*.6.1	Section 1607*A*.6
18.	Hospitals	Corridors above first floor	80	1,000	—
		Operating rooms, laboratories	60	1,000	
		Patient rooms	40	1,000	
19.	Hotels (see residential)		—	—	—
20.	Libraries[d]	Corridors above first floor	80	1,000	—
		Reading rooms	60	1,000	—
		Stack rooms	150[b]	1,000	Section 1607*A*.17
21.	Manufacturing	Heavy	250[b]	3,000	—
		Light	125[b]	2,000	
22.	Marquees, except one- and two-family dwellings		75	—	—
23.	Office buildings[b]	Corridors above first floor	80	2,000	—
		File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—	
		Lobbies and first-floor corridors	100	2,000	
		Offices	50	2,000	
24.	Penal institutions	Cell blocks	40	—	—
		Corridors	100		
25.	Public restrooms		Same as live load for area served but not required to exceed 60 psf	—	—
26.	Recreational uses	Bowling alleys, poolrooms and similar uses	75[a]	—	—
		Dance halls and ballrooms	100[a]		
		Gymnasiums	100[a]		
		Theater projection, control, and follow spot rooms	50		
		Ice skating rinks	250[b]		
		Roller skating rinks	100[a]		

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TABLE 1607*A*.1—MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS—continued

	OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
27.	Residential	One- and two-family dwellings:		—	Section 1607*A*.21
		Uninhabitable attics without storage	10		
		Uninhabitable attics with storage	20		
		Habitable attics and sleeping areas	30		
		Canopies, including marquees	20		
		All other areas	40		
		Hotels and multifamily dwellings:			
		Private rooms and corridors serving them	40		
		Public rooms	100[a]		
		Corridors serving public rooms	100		
28.	Roofs	Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	—	Section 1607*A*.14
		Roof areas used for assembly purposes	100[a]	—	
		Roof areas used for occupancies other than assembly	Same as occupancy served	—	
		Vegetative and landscaped roofs:			
		Roof areas not intended for occupancy	20	—	
		Roof areas used for assembly purposes	100[a]	—	
		Roof areas used for occupancies other than assembly	Same as occupancy served	—	
		Awnings and canopies:			
		Fabric construction supported by a skeleton structure	5[a]	—	
		All other construction, except one- and two-family dwellings	20	—	
		Primary roof members exposed to a work floor:			Section 1607*A*.15
		Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages	—	2,000	
		All other primary roof members	—	300	
		All roof surfaces subject to maintenance workers	—	300	
29.	Schools[d]	Classrooms	40 ***[DSA-SS]*** *50*[f]	1,000	—
		Corridors above first floor	80	1,000	
		First-floor corridors	100	1,000	
30.	Scuttles, skylight ribs and accessible ceilings		—	200	—
31.	Sidewalks, vehicular driveways and yards, subject to trucking		250[b]	8,000	Section 1607*A*.19
32.	Stairs and exits	One- and two-family dwellings	40	300	Section 1607*A*.20
		All other	100	300	Section 1607*A*.20
33.	Storage areas above ceilings		20	—	—

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TABLE 1607*A*.1—MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS—continued

OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
34.	Storage warehouses (shall be designed for heavier loads if required for anticipated storage)	Heavy	250[b]	—	—
		Light	125[b]		
35.	Stores	Retail:			—
		First floor	100	1,000	
		Upper floors	75	1,000	
		Wholesale, all floors	125[b]	1,000	
36.	Vehicle barriers		See Section 1607*A*.11		—
37.	Walkways and elevated platforms (other than exitways)		60	—	—
38.	Yards and terraces, pedestrian[h]		100[a]	—	—
39.	*Storage racks and wall-hung cabinets.*		*Total loads*[d]	—	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN.

a. Live load reduction is not permitted.

b. Live load reduction is only permitted in accordance with Section 1607*A*.13.1.2 or Item 1 of Section 1607*A*.13.2.

c. Live load reduction is only permitted in accordance with Section 1607*A*.13.1.3 or Item 2 of Section 1607*A*.13.2.

d. The minimum vertical design live load shall be as follows:

Paper media:

12-inch-deep (305 mm) shelf 33 pounds per lineal foot (482 N/m)

15-inch-deep (381 mm) shelf 41 pounds per lineal foot (598 N/m), or

33 pounds per cubic foot (5183 N/m^3) per total volume of the rack or cabinet, whichever is less.

Film media:

18-inch-deep (457 mm) shelf 100 pounds per lineal foot (1459 N/m), or

50 pounds per cubic foot (7853 N/m^3) per total volume of the rack or cabinet, whichever is less.

Other media:

20 pounds per cubic foot (311 N/m^3) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

*e. **[DSA-SS]** The following minimum loads for stage accessories apply:*

1. *Gridirons and fly galleries: 75 pounds per square foot uniform live load.*
2. *Loft block wells: 250 pounds per lineal foot vertical load and lateral load.*
3. *Head block wells and sheave beams: 250 pounds per lineal foot vertical load and lateral load. Head block wells and sheave beams shall be designed for all tributary loft block well loads. Sheave blocks shall be designed with a safety factor of five.*
4. *Scenery beams where there is no gridiron: 300 pounds per lineal foot vertical load and lateral load.*
5. *Ceiling framing over stages shall be designed for a uniform live load of 20 pounds per square foot. For members supporting a tributary area of 200 square feet or more, this additional load may be reduced to 15 pounds per square foot.*

*f. **[DSA-SS]** Live load reduction is not permitted for classrooms classified as Group A occupancies.*

*g. **[DSA-SS]** The minimum uniform live load for a press box floor or accessible roof with railing is 100 psf.*

*h. **[DSA-SS]** Item 38 applies to pedestrian bridges and walkways that are not subjected to uncontrolled vehicle access.*

1607*A*.2 Loads not specified. For occupancies or uses not designated in Section 1607*A*, the live load shall be determined in accordance with a method approved by the building official.

1607*A*.3 Uniform live loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed live loads given in Table 1607*A*.1. Live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607*A*.3.1 Partial loading of floors. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. Uniform floor live loads applied to selected spans are permitted to be reduced in accordance with Section 1607*A*.13.

1607*A*.3.2 Partial loading of roofs. Where uniform roof live loads are reduced to less than 20 pounds per square foot (0.96 kN/m^2) in accordance with Section 1607*A*.14.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect.

1607*A*.4 Concentrated live loads. Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607*A*.3 or the concentrated live loads, given in Table 1607*A*.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentrated load shall be assumed to be uniformly distributed over an area of $2^1/_2$ feet by $2^1/_2$ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

1607*A*.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents. The partition load shall be not less than a live load of 15 pounds per square foot (0.72 kN/m^2) and live load reductions in accordance with Section 1607*A*.13 are not permitted to be applied to the partition loads.

Exception: A partition live load is not required where the minimum specified live load is 80 pounds per square foot (3.83 kN/m^2) or greater.

1607*A*.6 Helipads. Helipads shall be marked to indicate the maximum takeoff weight. The takeoff weight limitation shall be indicated in units of thousands of pounds and placed in a box that is located in the bottom right corner of the landing area as viewed from the primary approach path. The box shall be not less than 5 feet (1524 mm) in height.

1607*A*.6.1 Concentrated loads. Helipads shall be designed for the following concentrated live loads:

1. A single concentrated live load, *L*, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.
2. Two single concentrated live loads, *L*, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum takeoff weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

1607*A*.7 Passenger vehicle garages. Floors in garages and portions of a building used for the storage of motor vehicles shall be designed for the uniformly distributed live loads indicated in Table 1607.1 or the following concentrated load:

1. For garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds (13.35 kN) acting on an area of 4.5 inches by 4.5 inches (114 mm by 114 mm).
2. For mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds (10 kN) per wheel.

1607*A*.8 Heavy vehicle loads. Floors and other surfaces that are intended to support vehicle loads greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607*A*.8.1 through 1607*A*.8.5.

1607*A*.8.1 Loads. Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue, in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

1607*A*.8.2 Fire truck and emergency vehicles. Where a structure or portions of a structure are accessed by fire department vehicles and other similar emergency vehicles, those portions of the structure subject to such loads shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official.
2. The live loading specified in Section 1607*A*.8.1.

Emergency vehicle loads need not be assumed to act concurrently with other uniform live loads.

1607*A*.8.3 Heavy vehicle garages. Garages designed to accommodate vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607*A*.8.1. For garages the design for impact and fatigue is not required.

Exception: The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided that such loads and placement are based on rational engineering principles and are approved by the building official, but shall be not less than 50 psf (2.39 kN/m^2). This live load shall not be reduced.

1607*A*.8.4 Forklifts and movable equipment. Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted in accordance with Section 1607*A*.8.5.

1607*A*.8.4.1 Impact and fatigue. Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

1607*A*.8.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted by the owner or the owner's authorized agent in accordance with Section 106.1.

1607*A*.9 Loads on handrails, guards, grab bars and seats. Handrails and guards shall be designed and constructed for the structural loading conditions set forth in Section 1607*A*.9.1. Grab bars, shower seats and accessible benches shall be designed and constructed for the structural loading conditions set forth in Section 1607*A*.9.2.

1607*A*.9.1 Concentrated load. Handrails and guards shall be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7. Glass handrail assemblies and guards shall comply with Section 2407.

1607*A*.9.1.1 Uniform load. Handrails and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1.1 of ASCE 7. This load need not be assumed to act concurrently with the concentrated load specified in Section 1607*A*.9.1.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607*A*.9.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

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3. For roofs not intended for occupancy, only the single concentrated load required by Section 1607*A*.9.1 shall be applied.

1607*A*.9.1.2 Guard component loads. Balusters, panel fillers and guard infill components, including all rails except the handrail and the top rail, shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1.2 of ASCE 7.

1607*A*.9.2 Grab bars, shower seats and accessible benches. Grab bars, shower seats and accessible benches shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar, shower seat, or seat of the accessible bench so as to produce the maximum load effects. ***[DSA-AC & HCD 1-AC]*** *See Chapter 11A, Section 1127A.4 and Chapter 11B, Sections 11B-609.8, 11B-610.4 and 11B-903.6 for grab bars, shower seats and dressing room bench seats, as applicable.*

1607*A*.10 Fixed ladders. Fixed ladders with rungs shall be designed to resist a single concentrated load of 300 pounds (1.33 kN) in accordance with Section 4.5.4 of ASCE 7. Where rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall be designed to resist a single concentrated load of 100 pounds (0.445 kN) in accordance with Section 4.5.4 of ASCE 7. Ship's ladders shall be designed to resist the stair loads given in Table 1607*A*.1.

1607*A*.11 Vehicle barriers. Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provisions for traffic railings.

1607*A*.12 Impact loads. The live loads specified in Sections 1607*A*.3 through 1607*A*.11 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607*A*.12.1 Elevators. Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1/CSA B44.

1607*A*.12.2 Machinery. For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact:

1. Light machinery, shaft- or motor-driven, 20 percent.
2. Reciprocating machinery or power-driven units, 50 percent.

Percentages shall be increased where specified by the manufacturer.

1607*A*.12.3 Elements supporting hoists for façade access and building maintenance equipment. In addition to any other applicable live loads, structural elements that support hoists for façade access and building maintenance equipment shall be designed for a live load of 2.5 times the rated load of the hoist or the stall load of the hoist, whichever is larger.

1607*A*.12.4 Fall arrest, lifeline, and rope descent system anchorages. In addition to any other applicable live loads, fall arrest, lifeline, and rope descent system anchorages and structural elements that support these anchorages shall be designed for a live load of not less than 3,100 pounds (13.8 kN) for each attached line, in any direction that the load can be applied.

Anchorages of horizontal lifelines and the structural elements that support these anchorages shall be designed for the maximum tension that develops in the horizontal lifeline from these live loads.

1607*A*.13 Reduction in uniform live loads. Except for uniform roof live loads, all other minimum uniformly distributed live loads, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607*A*.13.1 or 1607*A*.13.2. Uniform roof live loads are permitted to be reduced in accordance with Section 1607*A*.14.

1607*A*.13.1 Basic uniform live load reduction. Subject to the limitations of Sections 1607*A*.13.1.1 through 1607*A*.13.1.3 and Table 1607*A*.1, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m^2) or more are permitted to be designed for a reduced uniformly distributed live load, *L*, in accordance with the following equation:

Equation 16*A*-7
$$L = L_o\left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}}\right)$$

For SI:
$$L = L_o\left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}}\right)$$

where:

L = Reduced design live load per square foot (m^2) of area supported by the member.

L_o = Unreduced design live load per square foot (m^2) of area supported by the member (see Table 1607*A*.1).

K_{LL} = Live load element factor (see Table 1607*A*.13.1).

A_T = Tributary area, in square feet (m^2).

L shall be not less than $0.50L_o$ for members supporting one floor and *L* shall be not less than $0.40L_o$ for members supporting two or more floors.

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TABLE 1607*A*.13.1—LIVE LOAD ELEMENT FACTOR, K_{LL}	
ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
Members not previously identified including:	1
Edge beams with cantilever slabs	
Cantilever beams	
One-way slabs	
Two-way slabs	
Members without provisions for continuous shear transfer normal to their span	

1607*A*.13.1.1 One-way slabs. The tributary area, A_T, for use in Equation 16-7 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

1607*A*.13.1.2 Heavy live loads. Live loads that exceed 100 psf (4.79 kN/m^2) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the reduced live load shall be not less than L as calculated in Section 1607*A*.13.1.
2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

1607*A*.13.1.3 Passenger vehicle garages. The live loads shall not be reduced in passenger vehicle garages.

Exception: The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the reduced live load shall be not less than L as calculated in Section 1607*A*.13.1.

1607*A*.13.2 Alternative uniform live load reduction. As an alternative to Section 1607*A*.13.1 and subject to the limitations of Table 1607.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. For live loads not exceeding 100 pounds per square foot (4.79 kN/m^2), the design live load for structural members supporting 150 square feet (13.94 m^2) or more is permitted to be reduced in accordance with Equation 16*A*-8.

   Equation 16*A*-8 $R = 0.08(A - 150)$

   For SI: $R = 0.861(A - 13.94)$

   where:

   A = Area of floor supported by the member, square feet (m^2).

   R = Reduction in percent. Such reduction shall not exceed the smallest of:

   1.1. 40 percent for members supporting one floor.

   1.2. 60 percent for members supporting two or more floors.

   1.3. R as determined by the following equation:

   Equation 16*A*-9 $R = 23.1(1+ D/L_o)$

   where:

   D = Dead load per square foot (m^2) of area supported.

   L_o = Unreduced live load per square foot (m^2) of area supported.

2. A reduction shall not be permitted where the live load exceeds 100 pounds per square foot (4.79 kN/m^2) except that the design live load for members supporting two or more floors is permitted to be reduced by not greater than 20 percent.

   Exception: For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

3. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent.
4. For one-way slabs, the area, A, for use in Equation 16*A*-8 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

1607*A*.14 Reduction in uniform roof live loads. The minimum uniformly distributed live loads of roofs, marquees and canopies, L_o, in Table 1607*A*.1 are permitted to be reduced in accordance with Section 1607*A*.14.1.

1607*A*.14.1 Ordinary roofs, awnings and canopies. Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load, L_r, as specified in the following equations or other controlling combinations of loads as specified in Section 1605*A*, whichever produces the greater load effect.

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In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m^2).

Equation 16*A*-10 $L_r = L_o R_1 R_2$

where: $12 \le L_r \le 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \le L_r \le 0.96$

L_o = Unreduced roof live load per square foot (m^2) of horizontal projection supported by the member (see Table 1607*A*.1).

L_r = Reduced roof live load per square foot (m^2) of horizontal projection supported by the member.

The reduction factors R_1 and R_2 shall be determined as follows:

Equation 16*A*-11 $R_1 = 1$ for $A_t \le 200$ square feet (18.58 m^2)

Equation 16*A*-12 $R_1 = 1.2 - 0.001A_t$ for 200 square feet $< A_t <$ 600 square feet

Equation 16*A*-13 $R_1 = 0.6$ for $A_t \ge 600$ square feet (55.74 m^2)

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m^2) supported by the member, and

Equation 16*A*-14 $R_2 = 1$ for $F \le 4$

Equation 16*A*-15 $R_2 = 1.2 - 0.05F$ for $4 < F < 12$

Equation 16*A*-16 $R_2 = 0.6$ for $F \ge 12$

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607*A*.14.2 Occupiable roofs. Areas of roofs that are occupiable, such as vegetative roofs, landscaped roofs or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607*A*.13.

*

1607*A*.15 Crane loads. The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall be in accordance with Section 4.9 of ASCE 7.

1607*A*.16 Interior walls and partitions. Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m^2). *The 5 psf (0.24 kN/m^2) allowable stress design load need not be applied simultaneously with wind or seismic loads. The deflection of such walls under a load of 5 psf (0.24 kN/m^2) shall not exceed the limits in Table 1604A.3.*

1607*A*.16.1 Fabric partitions. Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the following load conditions:

1. The horizontal distributed load need only be applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch-diameter (203 mm) area [50.3 square inches (32 452 mm^2)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

1607*A*.16.2 Fire walls. In order to meet the structural stability requirements of Section 706.2 where the structure on either side of the wall has collapsed, fire walls and their supports shall be designed to withstand a minimum horizontal allowable stress load of 5 psf (0.240 kN/m^2).

1607*A*.17 Library stack rooms. The live loading indicated in Table 1607*A*.1 for library stack rooms applies to stack room floors that support nonmobile, double-faced library book stacks, subject to the following limitations:

1. The nominal book stack unit height shall not exceed 90 inches (2290 mm).
2. The nominal shelf depth shall not exceed 12 inches (305 mm) for each face.
3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches (914 mm) in width.

1607*A*.18 Seating for assembly uses. Bleachers, folding and telescopic seating and grandstands shall be designed for the loads specified in ICC 300 *as modified by Section 1605A.3 load combinations*. Stadiums and arenas with fixed seats shall be designed for the horizontal sway loads in Section 1607*A*.18.1.

1607*A*.18.1 Horizontal sway loads. The design of stadiums and arenas with fixed seats shall include horizontal swaying forces applied to each row of seats as follows:

1. 24 pounds per linear foot (0.35 kN/m) of seat applied in a direction parallel to each row of seats.
2. 10 pounds per linear foot (0.15 kN/m) of seat applied in a direction perpendicular to each row of seats.

The parallel and perpendicular horizontal swaying forces are not required to be applied simultaneously.

1607*A*.19 Sidewalks, vehicular driveways, and yards subject to trucking. The live loading indicated in Table 1607*A*.1 for sidewalks, vehicular driveways, and yards subject to trucking shall comply with the requirements of this section.

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1607*A*.19.1 Uniform loads. In addition to the loads indicated in Table 1607*A*.1, other uniform loads in accordance with an approved method that contains provisions for truck loading shall be considered where appropriate.

1607*A*.19.2 Concentrated loads. The concentrated wheel load indicated in Table 1607*A*.1 shall be applied on an area of $4^1/_2$ inches by $4^1/_2$ inches (114 mm by 114 mm).

1607*A*.20 Stair treads. The concentrated load indicated in Table 1607*A*.1 for stair treads shall be applied on an area of 2 inches by 2 inches (51 mm by 51 mm). This load need not be assumed to act concurrently with the uniform load.

1607*A*.21 Residential attics. The live loads indicated in Table 1607*A*.1 for attics in residential occupancies shall comply with the requirements of this section.

1607*A*.21.1 Uninhabitable attics without storage. In residential occupancies, uninhabitable attic areas without storage are those where the maximum clear height between the joists and rafters is less than 42 inches (1067 mm), or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607*A*.1 need not be assumed to act concurrently with any other live load requirement.

1607*A*.21.2 Uninhabitable attics with storage. In residential occupancies, uninhabitable attic areas with storage are those where the maximum clear height between the joist and rafter is 42 inches (1067 mm) or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607*A*.1 need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches (508 mm) in width by 30 inches (762 mm) in length that is located where the clear height in the attic is not less than 30 inches (762 mm).
2. The slope of the joists or truss bottom chords is not greater than 2 units vertical in 12 units horizontal.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot (0.48 kN/m^2).

1607*A*.21.3 Attics served by stairs. Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

1607*A*.22 Photovoltaic panel systems. Roof structures that provide support for photovoltaic panel systems shall be designed in accordance with Sections 1607*A*.22.1 through 1607*A*.22.5, as applicable. **

1607*A*.22.1 Roof live load. Roof structures that support photovoltaic panel systems shall be designed to resist each of the following conditions:

1. Applicable uniform and concentrated roof loads with the photovoltaic panel system dead loads.

   Exception: Roof live loads need not be applied to the area covered by photovoltaic panels where the clear space between the panels and the roof surface is 24 inches (610 mm) or less.
2. Applicable uniform and concentrated roof loads without the photovoltaic panel system present.

1607*A*.22.2 Photovoltaic panels or modules. The structure of a roof that supports solar photovoltaic panels or modules shall be designed to accommodate the full solar photovoltaic panels or modules and ballast dead load, including concentrated loads from support frames in combination with the loads from Section 1607*A*.22.1 and other applicable loads. Where applicable, snow drift loads created by the photovoltaic panels or modules shall be included.

1607*A*.22.3 Elevated photovoltaic (PV) support structures with open grid framing. Elevated photovoltaic (PV) support structures with open grid framing and without a roof deck or sheathing shall be designed to support the uniform and concentrated roof live loads specified in Section 1607*A*.22.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m^2).

1607*A*.22.4 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic (PV) panel systems are not required to accommodate a roof live load. Other loads and combinations in accordance with Section 1605*A* shall be accommodated.

1607*A*.22.5 Ballasted photovoltaic panel systems. Roof structures that provide support for ballasted photovoltaic panel systems shall be designed, or analyzed, in accordance with Section 1604*A*.4; checked in accordance with Section 1604*A*.3.6 for deflections; and checked in accordance with Section 1611*A* for ponding. ***[OSHPD 1 & 4]*** *Ballasted photovoltaic panel systems shall be considered as an alternative system.*

1607A.23 Uncovered open-frame roof structures. *Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m^2) of the total area encompassed by the framework.*

SECTION 1608*A*—SNOW LOADS

1608*A*.1 General. Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall be not less than that determined by Section 1607*A*.

Exception: Temporary structures complying with Section 3103.6.1.1.

1608*A*.2 Ground snow loads. The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with the reliability-targeted (strength based) ground snow load values in Chapter 7 of ASCE 7 or Figures 1608*A*.2(1) through 1608*A*.2(4) for the contiguous United States. Site-specific case studies shall be determined in accordance with Chapter 7 of ASCE 7 and shall be approved by the building official.

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FIGURE 1608A.2(1)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY I FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2. Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

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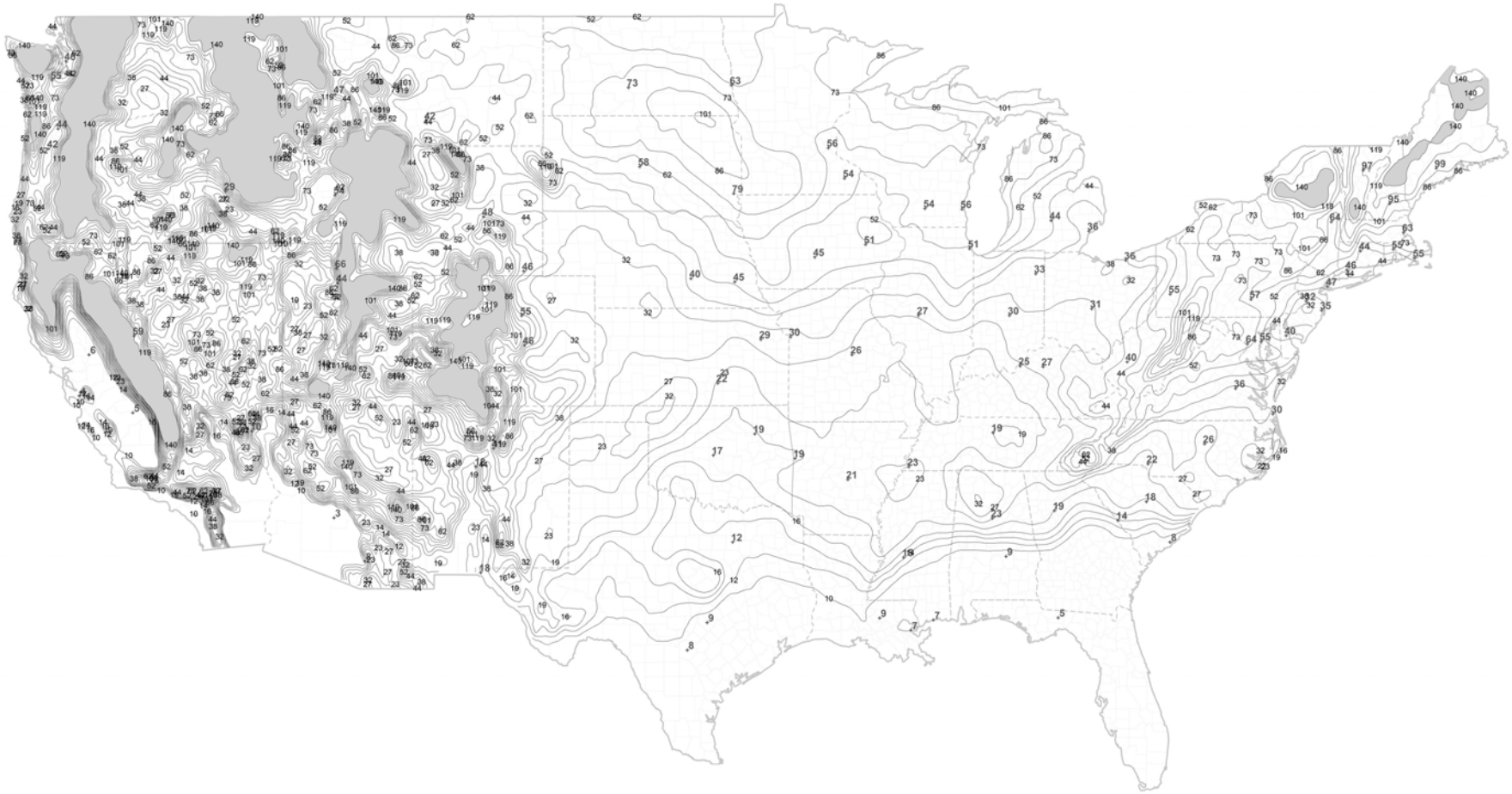

FIGURE 1608*A*.2(2)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY II FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2.

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or an approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

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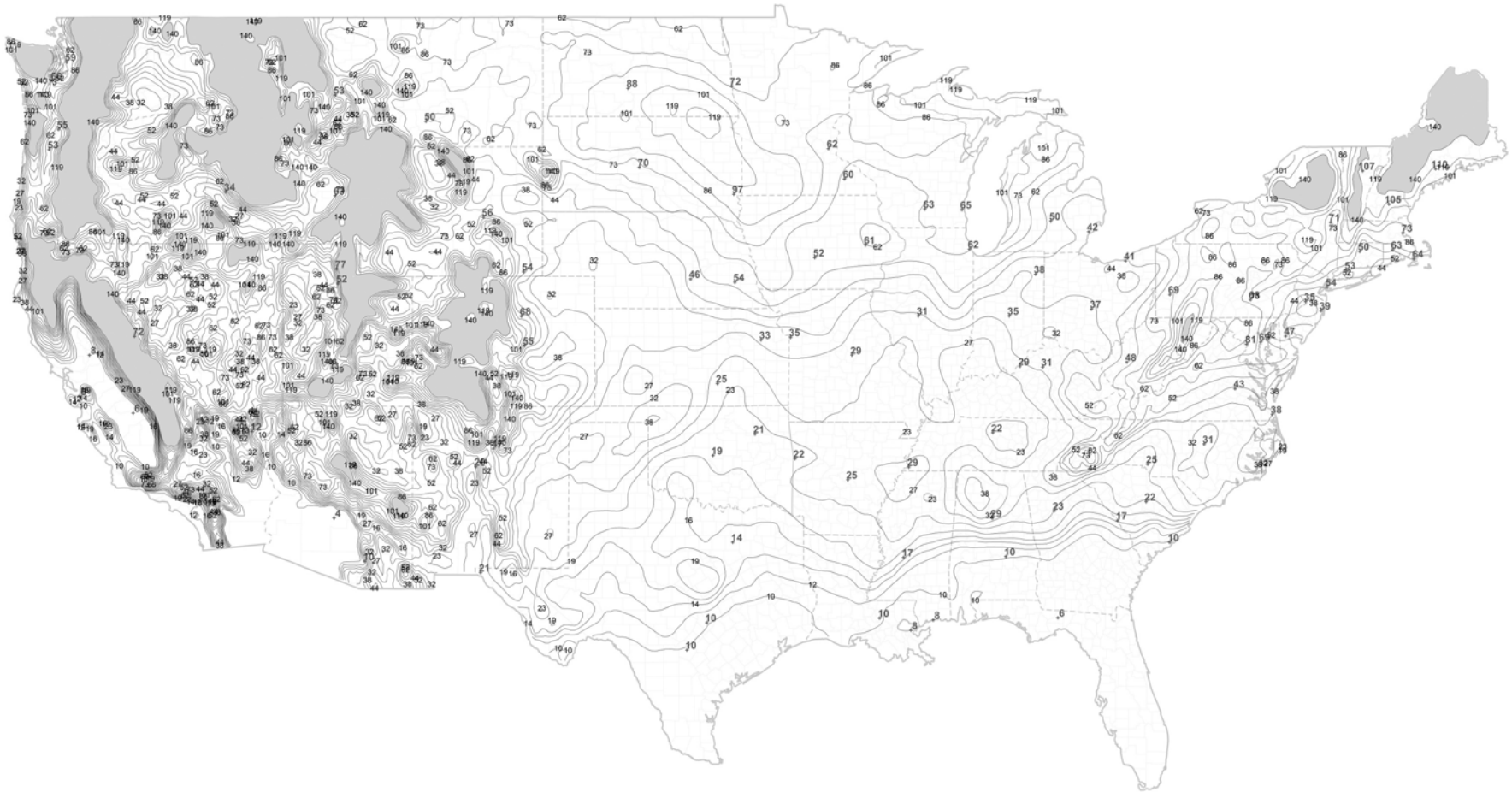

FIGURE 1608*A*.2(3)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY III FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2.

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or an approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

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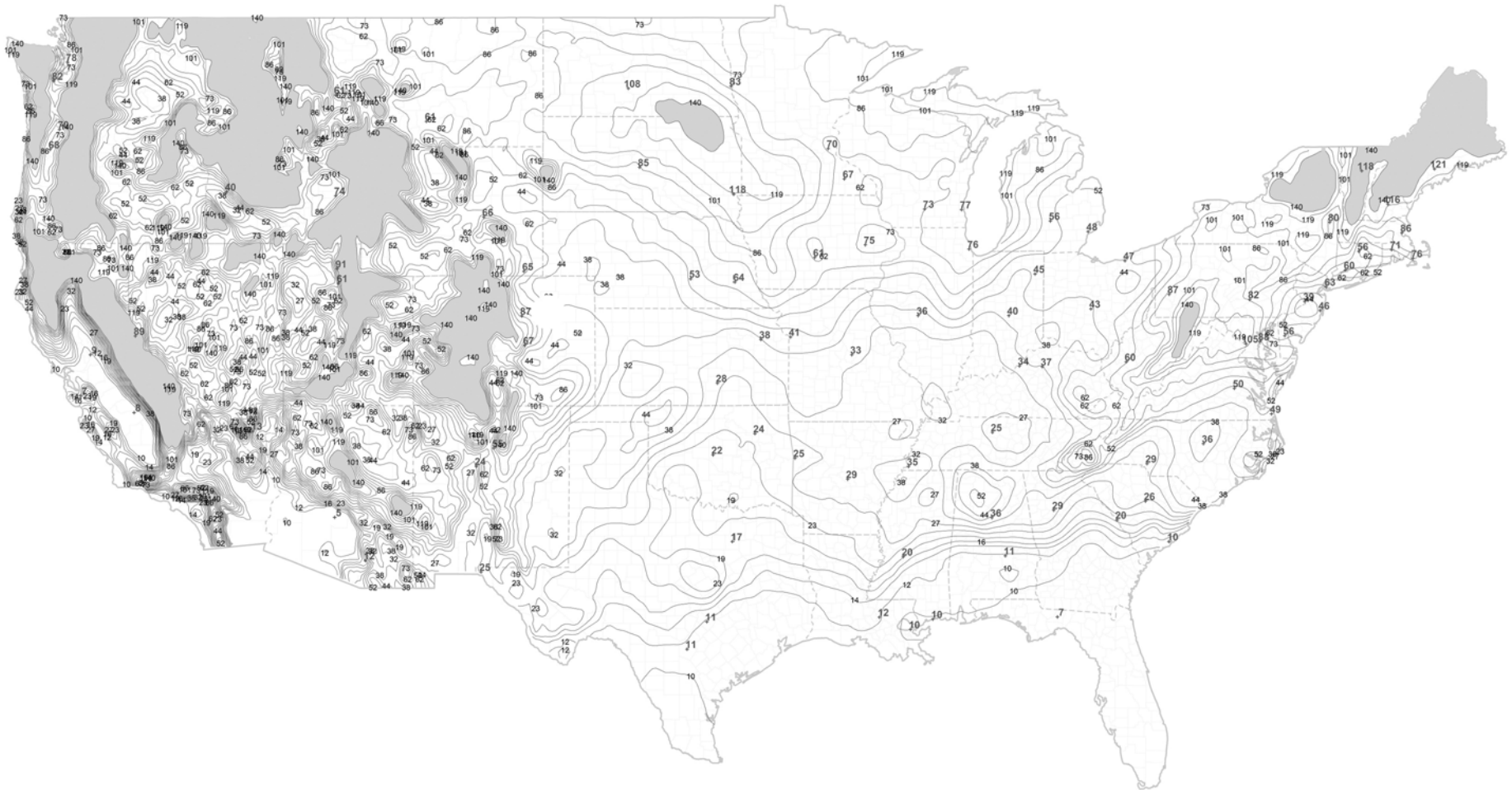

FIGURE 1608A.2(4)—GROUND SNOW LOADS, p_g, FOR RISK CATEGORY IV FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

For SI: 1 pound per square foot = 0.0479 kN/m^2.

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or an approved equivalent.
2. Lines shown on the figure are contours separated by a constant ratio 1.18 with values of 10, 12, 14, 16, 19, 23, 27, 32, 38, 44, 52, 62, 73, 86, 101, 119 and 140 psf.
3. Values denoted with a "+" symbol indicate design ground snow loads at state capitals or other high-population locations.
4. Areas shown in gray represent areas with ground snow loads exceeding 140 psf. Ground snow load values for these locations can be determined from the Geodatabase.

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1608*A*.2.1 Ground snow conversion. Where required, the ground snow loads, p_g, of Figures 1608*A*.2(1) through 1608*A*.2(4) and Table 1608*A*.2 shall be converted to allowable stress design ground snow loads, $p_{g(asd)}$, using Equation 16*A*-17.

Equation 16*A*-17 $p_{g(asd)} = 0.7p_g$

where:

$p_{g(asd)}$ = Allowable stress design ground snow load.

p_g = Ground snow load determined from Figures 1608*A*.2(1) through 1608*A*.2(4) and Table 1608*A*.2.

1608*A*.3 Ponding instability. Ponding instability on roofs shall be evaluated in accordance with ASCE 7.

1608A.4 Determination of snow loads. [DSA-SS] *The ground snow load or the design snow load for roofs shall conform with the adopted ordinance of the city, county, or city and county in which the project site is located, and shall be approved by DSA. See Section 106.1.2 for snow load posting requirements.*

SECTION 1609*A*—WIND LOADS

1609*A*.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

1609*A*.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic wind speed, *V*, and the exposure category for a site is permitted to be determined in accordance with Section 1609*A* or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609*A*.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609*A*.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609*A*.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.7 of ASCE 7.
7. Temporary structures complying with Section 3103.6.1.2.

The wind speeds in Figures 1609*A*.3(1) through 1609*A*.3(4) are basic wind speeds, *V*, and shall be converted in accordance with Section 1609.3.1 to allowable stress design wind speeds, V_{asd}, when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1609*A*.1.1.1 Applicability. The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609*A*.4. The provisions of ICC 600, AWC WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting all of the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C.
2. The maximum average slope of the hill exceeds 10 percent.
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 2 miles (3.22 km), whichever is greater.

1609A.1.2 Story drift for wind loads. *The calculated story drift due to wind pressures with ultimate design wind speed, V_{ult}, shall not exceed 0.008 times the story height for buildings less than 65 feet (19812 mm) in height or 0.007 times the story height for buildings 65 feet (19812 mm) or greater in height.*

Exception: [DSA-SS] *This story drift limit need not be applied for single-story open structures in Risk Categories I and II.*

Exception: [OSHPD 1 & 4] *This story drift limit need not be applied for single-story open structures.*

1609*A*.2 Protection of openings. In windborne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resistant standard or ASTM E1996 referenced herein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E1996.
2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E1996.

Exceptions:

1. Wood structural panels with a minimum thickness of $^{7}/_{16}$ inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in buildings with a mean roof height of 33 feet (10 058 mm) or less that are classified as a Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage

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method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609*A*.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where V_{asd} determined in accordance with Section 1609*A*.3.1 does not exceed 140 mph (63 m/s).

2. Glazing in Risk Category I buildings, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in Risk Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (457 m) of the building shall be permitted to be unprotected.

TABLE 1609*A*.2—WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS[a, b, c, d]

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
$^1/_4$-inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

a. This table is based a on 140 mph basic wind speed, *V*, and a 45-foot mean roof height.

b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located not less than 1 inch from the edge of the panel.

c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located not less than $2^1/_2$ inches from the edge of concrete block or concrete.

d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

1609*A*.2.1 Louvers. Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet the requirements of AMCA 540.

1609*A*.2.2 Garage doors. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

1609*A*.3 Basic wind speed. The basic wind speed, *V*, in mph, for the determination of the wind loads shall be determined by Figures 1609*A*.3(1) through 1609*A*.3(4). ⬅

The basic wind speed, *V*, for use in the design of Risk Category I buildings and structures shall be obtained from Figure 1609*A*.3(1).

The basic wind speed, *V*, for use in the design of Risk Category II buildings and structures shall be obtained from Figure 1609*A*.3(2).

The basic wind speed, *V*, for use in the design of Risk Category III buildings and structures shall be obtained from Figure 1609*A*.3(3).

The basic wind speed, *V*, for use in the design of Risk Category IV buildings and structures shall be obtained from Figure 1609*A*.3(4).

Basic wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined by using the ASCE Wind Design Geodatabase. The ASCE Wind Design Geodatabase is available at https://asce7hazardtool.online, or an approved equivalent.

The basic wind speed, *V*, for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The basic wind speeds, *V*, determined by the local jurisdiction shall be in accordance with Chapter 26 of ASCE 7.

In nonhurricane-prone regions, when the basic wind speed, *V*, is estimated from regional climatic data, the basic wind speed, *V*, shall be determined in accordance with Chapter 26 of ASCE 7.

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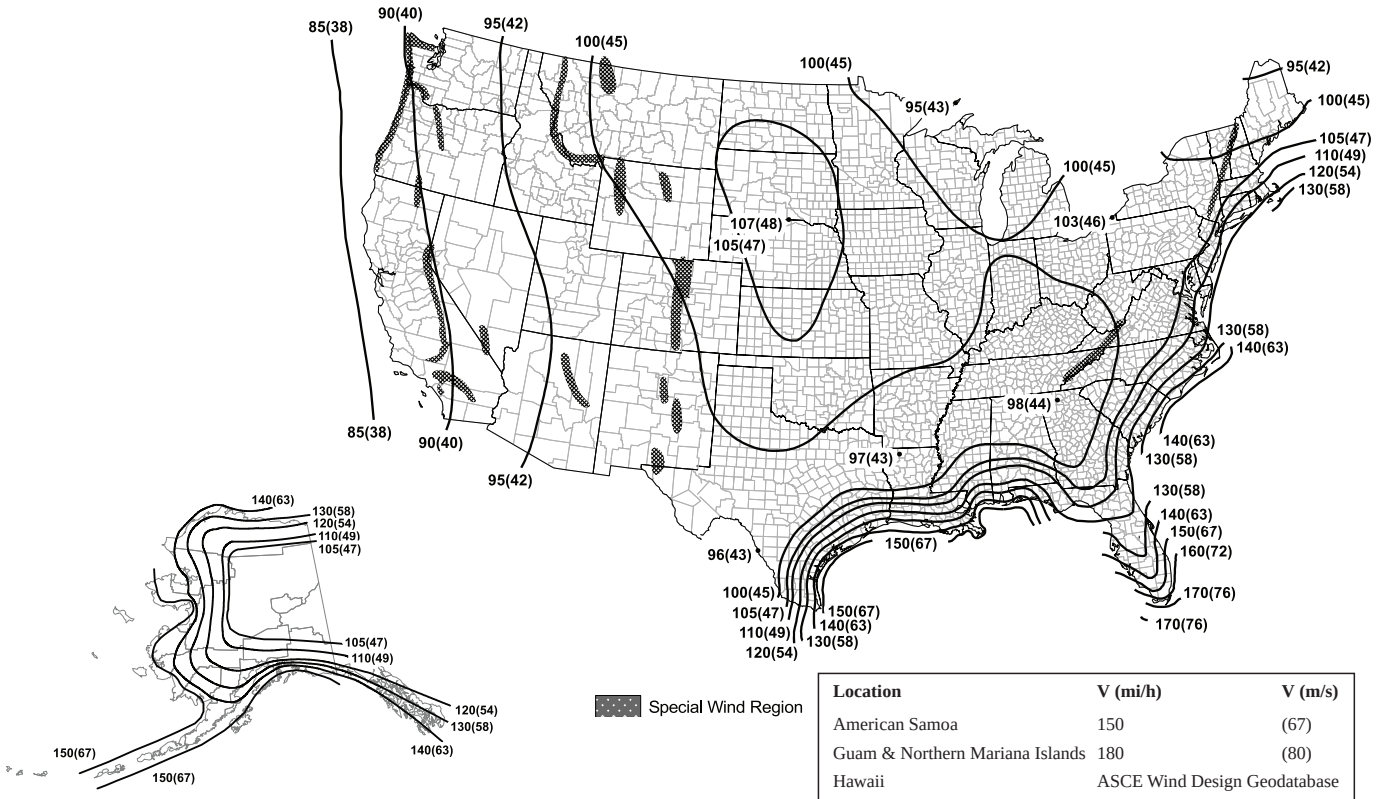
FIGURE 1609*A*.3(1)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES



Location	V (mi/h)	V (m/s)
American Samoa	150	(67)
Guam & Northern Mariana Islands	180	(80)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 15-percent probability of exceedance in 50 years (annual exceedance probability = 0.00333, MRI = 300 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

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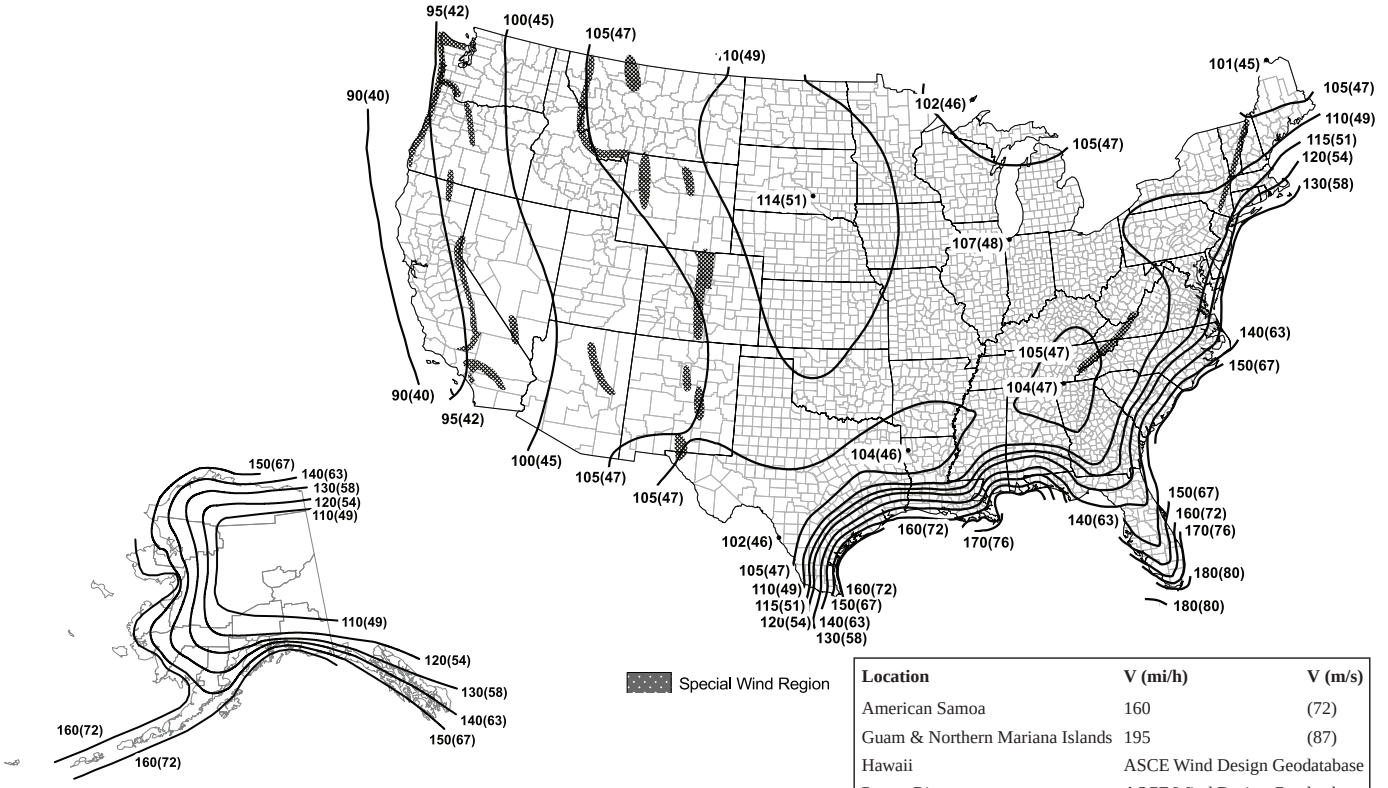
FIGURE 1609*A*.3(2)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES

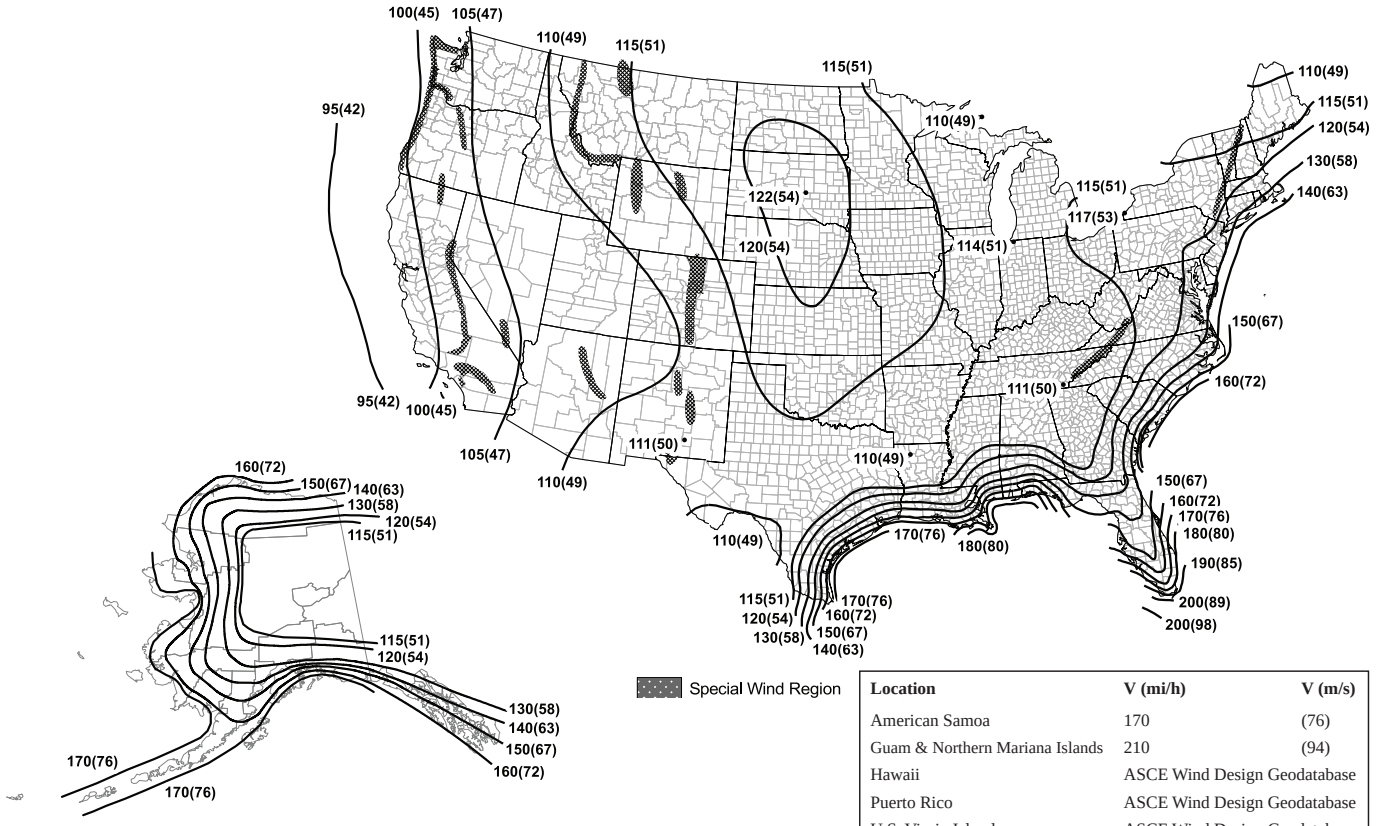


Location	V (mi/h)	V (m/s)
American Samoa	160	(72)
Guam & Northern Mariana Islands	195	(87)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 7-percent probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

FIGURE 1609*A*.3(3)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES

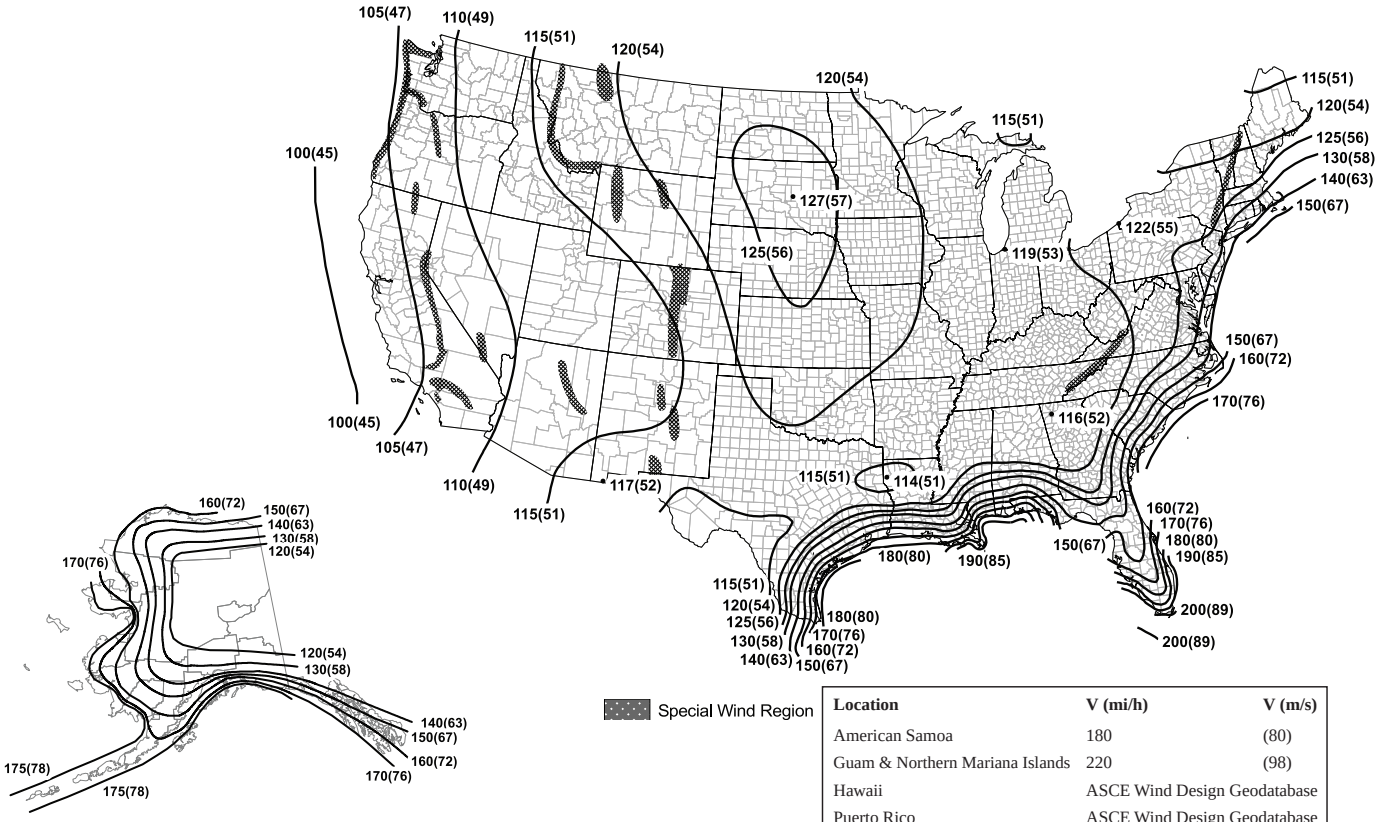


Location	V (mi/h)	V (m/s)
American Samoa	170	(76)
Guam & Northern Mariana Islands	210	(94)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 3-percent probability of exceedance in 50 years (annual exceedance probability = 0.000588, MRI = 1,700 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

FIGURE 1609*A*.3(4)—BASIC WIND SPEEDS, *V*, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES



Location	V (mi/h)	V (m/s)
American Samoa	180	(80)
Guam & Northern Mariana Islands	220	(98)
Hawaii	ASCE Wind Design Geodatabase	
Puerto Rico	ASCE Wind Design Geodatabase	
U.S. Virgin Islands	ASCE Wind Design Geodatabase	

Notes:

1. Values are 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas and land boundaries outside the last contour shall use the last wind speed contour.
4. Location-specific basic wind speeds shall be determined using the ASCE Wind Design Geodatabase.
5. Wind speeds for Hawaii, the US Virgin Islands and Puerto Rico shall be determined from the ASCE Wind Design Geodatabase.
6. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions. Site-specific values for selected special wind regions shall be determined using the ASCE Wind Design Geodatabase.
7. Wind speeds correspond to approximately a 1.6-percent probability of exceedance in 50 years (annual exceedance probability = 0.00033, MRI = 3,000 years).
8. The ASCE Wind Design Geodatabase can be accessed at the ASCE 7 Hazard Tool (https://asce7hazardtool.online) or approved equivalent.

1609*A*.3.1 Wind speed conversion. Where required, the basic wind speeds of Figures 1609*A*.3(1) through 1609*A*.3(4) shall be converted to allowable stress design wind speeds, V_{asd}, using Table 1609*A*.3.1 or Equation 16*A*-18.

Equation 16*A*-18 $V_{asd} = V\sqrt{0.6}$

where:

V_{asd} = Allowable stress design wind speed applicable to methods specified in Exceptions 4 and 5 of Section 1609*A*.1.1.

V = Basic wind speeds determined from Figures 1609*A*.3(1) through 1609*A*.3(4).

TABLE 1609*A*.3.1—WIND SPEED CONVERSIONS[a, b, c]

V	100	110	120	130	140	150	160	170	180	190	200
V_{asd}	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

a. Linear interpolation is permitted.

b. V_{asd} = allowable stress design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.

c. V = basic wind speeds determined from Figures 1609.3(1) through 1609*A*.3(4).

1609*A*.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

1609*A*.4.1 Wind directions and sectors. For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the

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selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609*A*.4.2 and 1609*A*.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609*A*.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the following categories, for the purpose of assigning an exposure category as defined in Section 1609*A*.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.

Surface Roughness D. Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

1609*A*.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

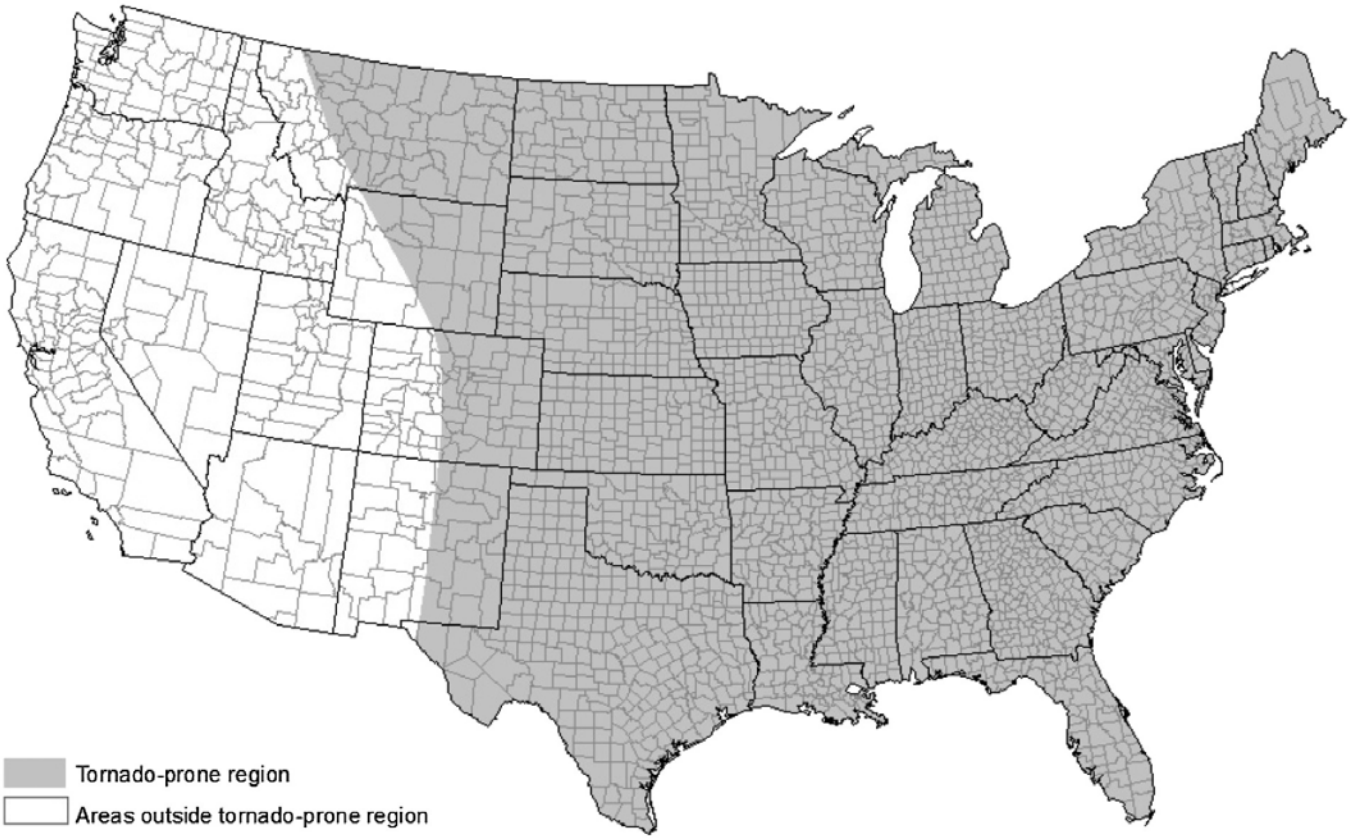
Exposure B. For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of not less than 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of not less than 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exposure C. Exposure C shall apply for all cases where Exposure B or D does not apply.

Exposure D. Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of not less than 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building height, whichever is greater, from an Exposure D condition as defined in the previous sentence.

1609*A*.5 Tornado loads. The design and construction of Risk Category III and IV buildings and other structures located in the tornado-prone region as shown in Figure 1609*A*.5 shall be in accordance with Chapter 32 of ASCE 7, except as modified by this code.

FIGURE 1609*A*.5—TORNADO-PRONE REGION



1609*A*.6 Roof systems. Roof systems shall be designed and constructed in accordance with Sections 1609*A*.6.1 through 1609*A*.6.3, as applicable.

1609*A*.6.1 Roof deck. The roof deck shall be designed to withstand the greater of wind pressures or tornado pressures determined in accordance with ASCE 7.

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1609*A*.6.2 Roof coverings. Roof coverings shall comply with Section 1609*A*.6.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609*A*.6.1 are permitted to be designed in accordance with Section 1609*A*.6.3.

1609*A*.6.2.1 Asphalt shingles. Asphalt shingles installed over a roof deck complying with Section 1609*A*.6.1 shall comply with the wind-resistance requirements of Section 1504.2.

1609*A*.6.3 Rigid tile. Wind and tornado loads on rigid tiles shall comply with Section 1609*A*.6.3.1 or 1609*A*.6.3.2, as applicable.

1609*A*.6.3.1 Aerodynamic uplift moment. The aerodynamic uplift moment for rigid tile roof coverings shall be determined in accordance with the following equation:

Equation 16*A*-19 $M_a = q_h K_d C_L b L L_a [1.0 - GC_p]$

For SI: $M_a = q_h K_d C_L b L L_a [1.0 - GC_p] / 1000$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1504.3.1.

GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

K_d = Wind directionality factor determined from Chapter 26 of ASCE 7.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

q_h = Wind velocity pressure, psf (kN/m^2) determined from Section 26.10.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing that has been designed as components and cladding.
3. An underlayment shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have not less than two-thirds of the tile's area free of mortar or adhesive contact.

1609*A*.6.3.2 Tornado loads. Tornado loads on rigid tile roof coverings shall be determined in accordance with Section 1609*A*.6.3.1, replacing q_h with q_{hT} and (GC_p) with $K_{vT}(GC_p)$ in Equation 16*A*-19, where:

q_{hT} = tornado velocity pressure, pounds per square foot (kN/m^2) determined in accordance with Section 32.10 of ASCE 7.

K_{vT} = tornado pressure coefficient adjustment factor for vertical winds, determined in accordance with Section 32.14 of ASCE 7.

1609*A*.7 Elevators, escalators and other conveying systems. Elevators, escalators and other conveying systems and their components exposed to outdoor environments shall satisfy the wind design requirements of ASCE 7.

SECTION 1610*A*—SOIL LOADS AND HYDROSTATIC PRESSURE

1610*A*.1 Lateral pressures. Structures below grade shall be designed to resist lateral soil loads from adjacent soil *in accordance with Sections 1807A.1.1 and 1807A.2.2, respectively.* Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Walls that are free to move and rotate at the top, such as retaining walls, shall be permitted to be designed for active pressure.

Where applicable, lateral pressure from fixed or moving surcharge loads shall be added to the lateral soil load. Lateral pressure shall be increased if expansive soils are present at the site. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805*A*.4.2 and 1805*A*.4.3.

Exception: Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

Note: *Sections 1807A.1.1 and 1807A.2.2 require the foundation and retaining walls be designed using the lateral soil loads determined by a geotechnical investigation in accordance with Section 1803A. Section 1807A.2.2 requires that design lateral soil load be at least 80 percent of the design lateral soil loads in accordance with Table 1610A.1.*

TABLE 1610*A*.1—LATERAL SOIL LOAD

DESCRIPTION OF BACKFILL MATERIAL[c]	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD[a] (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.

b. Unsuitable as backfill material.

c. The definition and classification of soil materials shall be in accordance with ASTM D2487.

1610*A*.2 Uplift loads on floor and foundations. Basement floors, slabs on ground, foundations, and similar approximately horizontal elements below grade shall be designed to resist uplift loads where applicable. The upward pressure of water shall be taken as the full hydrostatic pressure applied over the entire area. The hydrostatic load shall be measured from the underside of the element being evaluated. The design for upward loads caused by expansive soils shall comply with Section 1808*A*.6.

SECTION 1611*A*—RAIN LOADS

1611*A*.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater as per the requirements of Chapter 8 of ASCE 7. Rain loads shall be based on the summation of the static head, d_s, hydraulic head, d_h, and ponding head, d_p, using Equation 16*A*-20. The hydraulic head shall be based on hydraulic test data or hydraulic calculations assuming a flow rate corresponding to a rainfall intensity equal to or greater than the 15-minute duration storm with return period given in Table 1611*A*.1. Rainfall intensity shall be determined in inches per hour for 15-minute duration storms for the risk categories given in Table 1611*A*.1. The ponding head shall be based on structural analysis as the depth of water due to deflections of the roof subjected to unfactored rain load and unfactored dead load.

Equation 16*A*-20 $R = 5.2(d_s + d_h + d_p)$

For SI: $R = 0.0098(d_s + d_h + d_p)$

where:

d_h = Hydraulic head equal to the depth of water on the undeflected roof above the inlet of the secondary drainage system for structural loading (SDSL) required to achieve the design flow, in inches (mm).

d_p = Ponding head equal to the depth of water due to deflections of the roof subjected to unfactored rain load and unfactored dead load, in inches (mm).

d_s = Static head equal to the depth of water on the undeflected roof up to the inlet of the secondary drainage system for structural loading (SDSL), in inches (mm).

R = Rain load, in pounds per square foot (kN/m^2).

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SDSL is the roof drainage system through which water is drained from the roof when the drainage systems listed in ASCE 7 Section 8.2 (a) through (d) are blocked or not working.

TABLE 1611*A*.1—DESIGN STORM RETURN PERIOD BY RISK CATEGORY	
RISK CATEGORY	**DESIGN STORM RETURN PERIOD**
I & II	100 years
III	200 years
IV	500 years

1611*A*.2 Ponding instability. Ponding instability on roofs shall be evaluated in accordance with ASCE 7.

1611*A*.3 Controlled drainage. Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611*A*.1. Such roofs shall be checked for ponding instability in accordance with Section 1611*A*.2.

SECTION 1612*A*—FLOOD LOADS

1612*A*.1 General. Within flood hazard areas as established in Section 1612*A*.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

1612*A*.2 Design and construction. The design and construction of buildings and structures located in flood hazard areas, including coastal high hazard areas and coastal A zones, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24. Elevators, escalators, conveying systems and their components shall conform to ASCE 24 and ASME A17.1/CSA B44 as applicable.

Exception: Temporary structures complying with Section 3103.6.1.3.

1612*A*.3 Establishment of flood hazard areas. To establish flood hazard areas, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management *Agency's Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located,* as amended or revised with the accompanying *Flood Insurance Rate Map* (*FIRM*) and Flood Boundary and *Floodway* Map (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

1612*A*.3.1 Design flood elevations. Where design flood elevations are not included in the flood hazard areas established in Section 1612*A*.3, or where floodways are not designated, the building official is authorized to require the applicant to do one of the following:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source.
2. Determine the design flood elevation or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

1612*A*.3.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

1612*A*.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas other than coastal high hazard areas or coastal A zones:
   - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.
   - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.
   - 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24 and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.
   - 1.4. For dry floodproofed nonresidential buildings, the elevation to which the building is dry floodproofed as required for the final inspection in Section 110.3.12.1.

2. For construction in coastal high hazard areas and coastal A zones:
   2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.
   2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
   2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m^2) determined using allowable stress design or a resistance to an ultimate load of more than 33 pounds per square foot (1.58 kN/m^2), construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.
   2.4 For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

SECTION 1613*A*—EARTHQUAKE LOADS

1613*A*.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The seismic design category for a structure is permitted to be determined in accordance with Section 1613*A* or ASCE 7.

1613*A*.2 Determination of seismic design category. Structures shall be assigned to a Seismic Design Category *D or higher* based on one of the following methods unless the authority having jurisdiction or geotechnical data determines that Site Class DE, E or F soils are present at the site:

1. Based on the structure risk category using Figure 1613.2(1).
2. Determined in accordance with ASCE 7.

Where Site Class DE, E or F soils are present, the seismic design category shall be determined in accordance with ASCE 7.

1613*A*.3 Simplified design procedure. *Not permitted by DSA-SS and OSHPD.*

1613*A*.4 Ballasted photovoltaic panel systems. Ballasted, roof-mounted photovoltaic panel systems need not be rigidly attached to the roof or supporting structure.

[DSA-SS] *Ballasted, roof-mounted photovoltaic panel systems shall comply with ASCE 7, Section 13.6.12.* ***[OSHPD 1 & 4]*** *Ballasted photovoltaic panel systems shall be considered as an alternative system.*

1613*A*.5 Elevators, escalators and other conveying systems. Elevators, escalators and other conveying systems and their components shall satisfy the seismic requirements of ASCE 7 and ASME A17.1/CSA B44 as applicable.

1613*A*.6 Automatic sprinkler systems. Where required, automatic sprinkler systems, including anchorage and bracing, shall comply with ASCE 7 and Section 903.3.1.1.

SECTION 1614*A*—ATMOSPHERIC ICE LOADS

1614*A*.1 General. Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

Exception: Temporary structures complying with Section 3103.6.1.5.

SECTION 1615*A*—TSUNAMI LOADS

1615*A*.1 General. The design and construction of Risk Category III and IV buildings and structures located in the *Tsunami Design Zones* defined in the *ASCE Tsunami Design Geodatabase, or other data determined applicable by the enforcement agency,* shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code. ***[DSA-SS]*** *Tsunami Risk Category for public school, community college and state-owned or state-leased essential services buildings and structures shall be identified and submitted for acceptance by DSA. Determination of the Tsunami Risk Category shall be proposed by the design professional in general responsible charge in coordination with the owner and local community based upon the relative importance of that facility to provide vital services, provide important functions and protect special populations. The determination of relative importance shall include consideration of a tsunami warning and evacuation plan and procedure when adopted by the local community.*

Exception: Temporary structures complying with Section 3103.6.1.6.

SECTION 1616*A*—STRUCTURAL INTEGRITY

1616*A*.1 General. High-rise buildings that are assigned to Risk Category III or IV shall comply with the requirements of Section 1616*A*.2 if they are frame structures, or Section 1616*A*.3 if they are bearing wall structures.

1616*A*.2 Frame structures. Frame structures shall comply with the requirements of this section.

1616*A*.2.1 Concrete frame structures. Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of Section 4.10 of ACI 318. Where ACI 318 requires that nonprestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the

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required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

Exception: Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

1616*A*.2.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures. Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

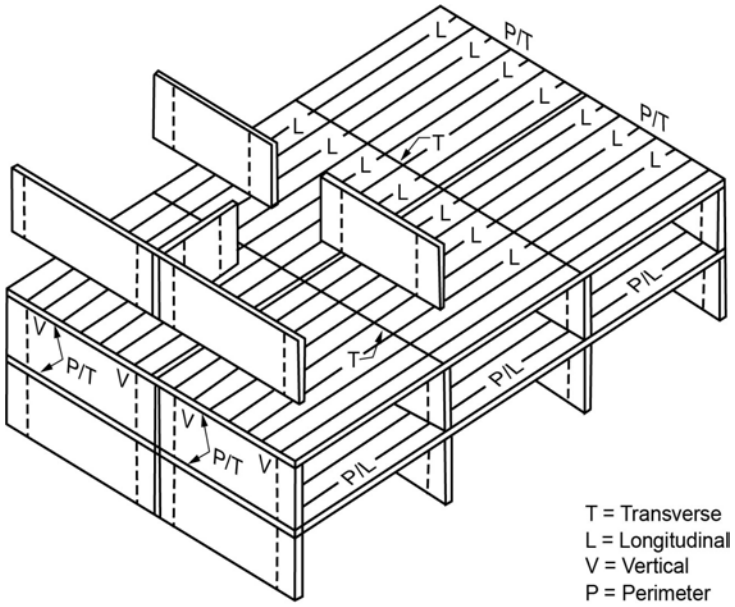
1616*A*.2.2.1 Columns. Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

1616*A*.2.2.2 Beams. End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for allowable stress design (ASD) or two-thirds of the required shear strength for load and resistance factor design (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

Exception: Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than $^{3}/_{8}$-inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two orthogonal directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for LRFD, but not less than 10 kips (45 kN).

1616*A*.3 Bearing wall structures. Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1616*A*.3.

FIGURE 1616*A*.3—LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES



1616*A*.3.1 Concrete wall structures. Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 16.2.4 and 16.2.5 of ACI 318.

1616*A*.3.2 Other bearing wall structures. Ties in bearing wall structures other than those covered in Section 1616*A*.3.1 shall conform to this section.

1616*A*.3.2.1 Longitudinal ties. Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength, T_T, given by Equation 16*A*-21. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

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Equation 16*A*-21 $T_T = w\,LS \le \alpha_T S$

where:

L = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).

w = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m^2).

S = The spacing between ties, feet (m).

α_T = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.

1616*A*.3.2.2 Transverse ties. Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed not farther apart than the spacing of load-bearing walls. Transverse ties shall have minimum nominal tensile strength T_T, given by Equation 16*A*-21. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

1616*A*.3.2.3 Perimeter ties. Perimeter ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than T_p, given by Equation 16*A*-22. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

Equation 16*A*-22 $T_p = 200w \le \beta_T$

For SI: $T_p = 90.7w \le \beta_T$

where:

w = As defined in Section 1616*A*.3.2.1.

β_T = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing walls and a value of 4,000 pounds (1300 kN) for structures with bearing walls of cold-formed steel light-frame construction.

1616*A*.3.2.4 Vertical ties. Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that story plus the weight of the diaphragm tributary to the wall in the story below. Not fewer than two ties shall be provided for each wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

SECTION 1617A—MODIFICATIONS TO ASCE 7

1617A.1 General. *The text of ASCE 7 shall be modified as indicated in Sections 1617A.1.1 through 1617A.1.41.*

1617A.1.1 ASCE 7, Section 1.3. *Modify ASCE 7, Section 1.3 by adding Section 1.3.8 as follows:*

1.3.8 Structural design criteria. *Where design is based on ASCE 7, Chapters 16, 17, 18 or 31, the seismic ground motion, wind tunnel test-based design recommendations, analysis and design methods, material assumptions, testing requirements and acceptance criteria shall be submitted to the enforcement agency as an alternative system.*

[DSA-SS] *Peer review requirements in Section 322 of the California Existing Building Code shall apply to design reviews required by ASCE 7, Chapters 17, 18, 31 and ASCE 49.*

[OSHPD 1 & 4] *Peer review requirements in Section 1617A.1.41 of this code shall apply to design reviews required by ASCE 7, Chapters 17, 18, 31 and ASCE 49.*

1617A.1.2 ASCE 7, Section 11.1.3. *Replace last paragraph of ASCE 7, Section 11.1.3, by the following:*

Non-building structures similar to buildings shall be designed and detailed in accordance with Chapter 12.

1617A.1.3 Reserved.

1617A.1.4 ASCE 7, Table 12.2-1. *Modify ASCE 7, Table 12.2-1 as follows:*

A. BEARING WALL SYSTEMS

6. Intermediate Precast Shear Walls—*Not permitted by OSHPD.*

18. Light-framed walls with shear panels of all other materials—*Not permitted by OSHPD and DSA-SS.*

B. BUILDING FRAME SYSTEMS

3. Steel ordinary concentrically braced frames— *Not permitted by OSHPD.*

9. Intermediate Precast Shear Walls—*Not permitted by OSHPD.*

25. Light-framed walls with shear panels of all other materials—*Not permitted by OSHPD and DSA-SS.*

27. Special steel plate shear wall—*Not permitted by OSHPD.*

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C. MOMENT-RESISTING FRAME SYSTEMS

2. Steel special truss moment frames—*Not permitted by OSHPD.*

3. Steel intermediate moment frames—*Not permitted by OSHPD except for single-story canopies and independent covered walkways where R, C_d and Ω_0 = 1.5 and the roof dead load is less than 20 psf.*

4. Steel ordinary moment frames—*Not permitted by OSHPD except for single-story canopies and independent covered walkways where R, C_d and Ω_0 = 1.5 and the roof dead load is less than 20 psf.*

12. Cold-formed steel–special bolted moment frame—*Not permitted by DSA-SS and OSHPD.*

G. CANTILEVER COLUMN SYSTEMS DETAILED TO CONFORM WITH THE REQUIREMENTS FOR:

1. Steel special cantilever column systems—*Not permitted by OSHPD except for single-story canopies and independent covered walkways where R, C_d and Ω_0 = 1.5 and roof dead load is less than 20 psf.*

3. Special reinforced concrete moment frames—Not permitted by OSHPD.

Exceptions:

1. *Systems listed in this section can be used as an alternative system when preapproved by the enforcement agency.*
2. *Rooftop or other supported structures not exceeding two stories in height and 10 percent of the total structure weight can use the systems in this section when designed as components per ASCE 7, Chapter 13.*
3. *Systems listed in this section can be used for seismically isolated buildings, when permitted by ASCE 7, Section 17.2.5.4.*

1617A.1.5 Reserved.

1617A.1.6 Reserved.

1617A.1.7 ASCE 7, Section 12.2.5.6.1 [DSA-SS] *The exception after the first paragraph is not permitted by DSA-SS.*

1617A.1.8 ASCE 7, Section 12.2.5.7.1 [DSA-SS] *The exception after the first paragraph is not permitted by DSA-SS.*

1617A.1.9 ASCE 7, Section 12.2.5.7.2 [DSA-SS] *The exception after the first paragraph is not permitted by DSA-SS.*

1617A.1.10 ASCE 7, Section 12.3.3.1. *Replace ASCE 7, Section 12.3.3.1 by the following:*

12.3.3.1 Prohibited vertical irregularities for Seismic Design Categories *D through* F. Structures assigned to Seismic Design Category *D*, E or F that have vertical irregularities Type 1b, 4a or 4b of Table 12.3-2 shall not be permitted.

Exception: Structures assigned to Seismic Design Category *D*, E or F that have vertical irregularity Type 4a shall be permitted where the story lateral strength is not less than 80% of that in the story above.

1617A.1.11 ASCE 7, Section 12.7.2. *Modify ASCE 7, Section 12.7.2, by adding Item 7 to read as follows:*

7. *Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a geotechnical engineer qualified in soils engineering plus the difference in earth pressures shall be added to the lateral forces provided in this section.*

1617A.1.12 ASCE 7, Section 12.10.2.1. *Replace Exception to ASCE 7, Section 12.10.2.1 by the following:*

Exception: In *light-frame* structures or portions thereof braced entirely by wood light-frame shear walls, collector elements and their connections, including connections to vertical elements, need only be designed to resist forces using the load combinations of Section 2.3.6 with seismic forces determined in accordance with Section 12.10.1.1.

1617A.1.13 ASCE 7, Section 12.13.5.2. *Modify ASCE 7, Section 12.13.5.2 by the following:*

Replace last sentence by the following: When vertical nominal strength (upward or downward) is determined by approved in-situ prototype testing program, resistance factor (ϕ) shall be permitted to be 0.75 (ϕ = 0.75).

1617A.1.14 Reserved.

1617A.1.15 ASCE 7, Section 12.13.1. *Modify ASCE 7, Section 12.13.1 by adding Section 12.13.1.1 as follows:*

12.13.1.1 Foundations and superstructure-to-foundation connections. *The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil. Stability against overturning and sliding shall be in accordance with Section 1605A.1.1.*

In addition, the foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. *The strength of the superstructure elements.*
2. *The maximum forces that can be delivered to the foundation in a fully yielded structural system.*
3. *Forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3.1.*

Exceptions:

1. *Where referenced standards specify the use of higher design loads.*
2. *When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.*
3. *Where seismic force-resisting system consists of light framed walls with shear panels, unless the reference standard specifies the use of higher design loads.*

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Where the computation of the seismic overturning moment is by the equivalent lateral-force method or the modal analysis method, reduction in overturning moment permitted by section 12.13.4 of ASCE 7 may be used.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

1617A.1.16 ASCE 7, Section 12.13.9.2. *Modify ASCE 7, Section 12.13.9.2 by adding the following sentence at the end of the exception:*

Seismic load effects determined in accordance with Section 12.4 need not be considered in this check.

1617A.1.17 ASCE 7, Section 13.1.3. [OSHPD 1 & 4] *Modify ASCE 7, Section 13.1.3 by the following:*

All nonstructural components shall have a component importance factor, I_p, equal to 1.5.

Exception: *Hospital buildings rated SPC-1 and SPC-2 not providing services/systems, utilities or access/egress to general acute care buildings designated as SPC 3 or higher in accordance with Chapter 6 of the California Administrative Code, shall be permitted to use component importance factor, I_p, as given in ASCE 7, Section 13.1.3.*

1617A.1.18 ASCE 7, Section 13.1.4. *Replace ASCE 7, Section 13.1.4, with the following:*

13.1.4. Nonstructural component and equipment support and attachment requirements: *The following nonstructural components and equipment shall be anchored in accordance with this section. Design and detailing shall be in accordance with Chapter 13 except as modified by this section.*

1. ***Fixed Equipment:*** *Equipment shall be anchored if it is directly attached to the building utility services such as electricity, gas or water. For the purposes of this requirement, "directly attached" shall include all electrical connections except plugs for 110/220-volt receptacles having a flexible cable/cord. Equipment that is connected to the building plumbing system with a shut-off valve in proximity to the equipment shall not be considered as directly attached provided the inside diameter of the pipe/tubing is less than $^1/_2$ inch (12.7 mm).*
2. ***Movable Equipment:*** *Equipment is subject to the same requirement as fixed equipment, but is permitted to be anchored by re-attachable anchors or restraints in a manner approved by the enforcement agency. Utilities and services at the equipment shall have flexible connections to allow for necessary movement.*
3. ***[OSHPD 1, 2, 4 & 5] Mobile Equipment:*** *Equipment heavier than 400 pounds (181.4 kg) that has a center of mass located 4 feet (1219 mm) or more above the adjacent floor or roof level that directly support the equipment shall be restrained in a manner approved by the enforcement agency when stored and not in use, unless the equipment is stored in an equipment storage room.*

   [DSA-SS] Mobile Equipment: *Equipment heavier than 400 pounds (181.4 kg) or has a center of mass located 4 feet (1219 mm) or more above the adjacent floor or roof level that directly supports the equipment shall be restrained in a manner approved by the enforcement agency. Mobile equipment shall be restrained when not in use and is stored, unless the equipment is stored in a storage room that does not house hazardous materials or any facility systems or fixed equipment that can be affected by mobile equipment lacking restraint.*
4. ***[OSHPD 1, 2, 4 & 5] Countertop Equipment:*** *Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed, movable, mobile or other equipment, as applicable.*

   [DSA-SS] Countertop Equipment: *Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed or movable equipment, as applicable. Countertop equipment shall also be subject to the same requirements as mobile or other equipment if weight of equipment is greater than 100 pounds (45 kg) and has a center of mass located 4 feet (1219 mm) or more above the adjacent floor level or if equipment could fall and block a required means of egress.*
5. ***[OSHPD 1, 2, 4 & 5] Temporary Equipment:*** *Equipment for uses greater than 30 days but less than or equal to 180 days and where this section requires supports and attachments, the following shall apply:*
   a. *Seismic design for supports and attachments for temporary equipment shall meet the requirements of Chapter 13; however, the calculated F_p may be reduced by 50 percent. It is acceptable to use ballasts for seismic bracing supports and attachments and to limit the design criteria to overturning unless directly or indirectly supported by the building structure.*
   b. *Wind design speeds may be reduced as prescribed in ASCE 37 or other standard approved by OSHPD.*
   c. *Temporary piping, conductors and ductwork shall be supported. Seismic design for supports and attachments of temporary piping, conductors and ductwork is not required.*
6. ***[OSHPD 1, 2, 4 & 5] Interim Equipment:***
   a. *Seismic design for supports and attachments for interim equipment shall meet the requirements of Chapter 13 with the following modifications; 1) The calculated F_p used in the design may be reduced by 50 percent. 2) It is acceptable to use ballasts for seismic or wind bracing supports and attachments and limit the design to overturning only without the consideration of sliding, unless directly or indirectly supported by the building structure. 3) Anticipated duration of use must be specified.*
   b. *Wind design speeds may be reduced as prescribed in ASCE 37-14 or other standard approved by OSHPD.*
   c. *Piping, conductors and ductwork shall be supported. Seismic design for supports and attachments of piping, conductors and ductwork is not required.*

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7. ***Other Equipment:*** *Equipment shall be anchored where any of the following apply:*
   a. ***[OSHPD 1, 2, 4 & 5]*** *Essential to hospital operations and weight of equipment is greater than 100 pounds (45 kg).*

      [DSA-SS] *Weight of equipment is greater than 100 pounds (45 kg) and essential to operations for emergency preparedness, communications and operations centers, and other facilities required for emergency response of state-owned essential services buildings as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.*
   b. ***[OSHPD 1, 2, 4 & 5]*** *Could fall within the patient care vicinity as defined in Article 517.2 of the California Electrical Code.*
   c. *Could fall and block a required means of egress.*
   d. ***[OSHPD 1, 2, 4 & 5]*** *Weight of equipment is greater than 400 pounds (181.4 kg).*
   e. ***[DSA-SS]*** *Weight of equipment is greater than 400 pounds (181.4 kg) or center of mass is located greater than 4 feet (1219 mm) above the finished floor or roof level that directly supports the component.*

      [OSHPD 1, 2, 4 & 5] *Weight of equipment is greater than 200 pounds (90 kg) and center of mass located greater than 4 feet (1219 mm) measured from the finished floor.*
8. *Equipment with hazardous contents.*
9. *Other architectural, mechanical and electrical components stated in Chapter 13.* ***[DSA-SS]*** *Cabinets shall be restrained in a manner approved by the enforcement agency if they could fall and block a required means of egress.*
10. ***Wall-, Roof- or Floor-Hung Equipment:*** *Seismic design and seismic details shall be provided for wall-, roof- or floor-hung nonstructural components and equipment when the component weighs more than 20 pounds (9 kg) or, in the case of a distribution system, 5 pounds per foot (73 N/m).*

[OSHPD 1, 2, 4 & 5] Exemptions:

1. *Furniture except storage cabinets as noted in Table 13.5-1.*
2. *Nonstructural components and equipment, that are attached to the building, provided that the component weighs 20 pounds (9 kg) or less or, in the case of a distribution system, 5 pounds per foot (73 N/m) or less. Seismic design and details need not be provided.*
3. *Seismic design need not be provided for discrete architectural, mechanical and electrical components and equipment that are attached to the building and anchorage is detailed on the construction documents, provided that the component weighs 400 pounds (181.4 kg) or less, and the center of mass is located 4 feet (1219 mm) or less above the adjacent floor or roof level that directly supports the component and flexible connections are provided between the component and associated ductwork, piping and conduit where required.*

[DSA-SS] Exemptions: *The following nonstructural components are exempt from the requirements of ASCE 7, Chapter 13:*

1. *Furniture except storage cabinets as noted in Table 13.5-1.*
2. *Nonstructural components and equipment that are positively attached to the structure, provided that the component weighs 20 pounds (9 kg) or less.*
3. *Discrete architectural, mechanical and electrical components and equipment that are positively attached to the structure, provided that the component weighs 400 pounds (181.4 kg) or less, and the center of mass is located 4 feet (1219 mm) or less above the adjacent floor or roof level that directly supports the component, flexible connections are provided between the component and associated ductwork, piping and conduit where required, and the component importance factor, I_p, is equal to 1.0.*

1617A.1.19 ASCE 7, Section 13.4 *Replace ASCE 7, Sections 13.4.2.3, with the following:*

13.4.2.3 Prequalified post-installed anchors and specialty inserts in concrete and masonry.

Post-installed anchors, post-installed reinforcing bars and specialty inserts in concrete that are pre-qualified for seismic applications in accordance with ACI 355.2, ACI 355.4, ICC-ES AC193, ICC-ES AC232, ICC-ES AC308 or ICC-ES AC446 shall be permitted. Post-installed anchors in masonry shall be pre-qualified for seismic applications in accordance with ICC-ES AC01 or AC58.

Note: *The removal and resetting of post-installed mechanical anchors are prohibited by ACI 318 Section 17.1.3.*

1617A.1.20 ASCE 7, Section 13.4.5 *Modify ASCE 7, Section 13.4.5 by adding Section 13.4.5.1 as follows:*

13.4.5.1 Power actuated fasteners. *Power actuated fasteners qualified in accordance with ICC ES AC 70 shall be deemed to satisfy the requirements of Section 13.4.5.*

Power actuated fasteners shall be permitted in seismic shear for components exempt from permit requirements by Section 1617A.1.18 of this code and for interior non-bearing non-shear wall partitions only. Power actuated fastener shall not be used to anchor seismic bracing, exterior cladding or curtain wall systems.

Exception: *Power actuated fasteners in steel to steel connections prequalified for seismic application by cyclic tests in accordance with ICC ES AC 70 shall be permitted for seismic design.*

1617A.1.21 ASCE 7, Section 13.5.6.2. *Modify ASCE 7, Section 13.5.6.2 by the following exception added to the end of Section 13.5.6.2.2 and by adding Section 13.5.6.2.3 as follows:*

Exception to Section 13.5.8.1 shall not be used in accordance with ASTM E580 Section 5.5.

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13.5.6.2.3 Modification to ASTM E580. *Modify ASTM E580 by the following:*

1. ***Exitways.*** *Lay-in ceiling assemblies in exitways shall be installed with a main runner or cross runner surrounding all sides of each piece of tile, board or panel and each light fixture or grille. A cross runner that supports another cross runner shall be considered as a main runner for the purpose of structural classification. Splices or intersections of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs or other approved connectors. Lateral force diagonal bracing may be omitted in the short or transverse direction of exitways, not exceeding 8 feet wide, when perimeter support in accordance with ASTM E580 Sections 5.2.2 and 5.2.3 is provided and the perimeter wall laterally supporting the ceiling in the short or transverse direction is designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces.*
2. ***Corridors and lobbies.*** *Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.*
3. ***Lay-in panels.*** *Metal panels and panels weighing more than $^1/_2$ pounds per square foot (24 N/m^2) other than acoustical tiles shall be positively attached to the ceiling suspension runners.*
4. ***Lateral force bracing.*** *Lateral force bracing is required for all ceiling areas except that they shall be permitted to be omitted in rooms with floor areas up to 144 square feet when perimeter support in accordance with ASTM E580, Sections 5.2.2 and 5.2.3, are provided and perimeter walls are designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces. Horizontal restraint point spacing shall be justified by analysis or test and shall not exceed a spacing of 12 feet by 12 feet. Bracing wires shall be secured with four tight twists in $1^1/_2$ inches, or an approved alternate connection.*
5. *Ceiling support and bracing wires shall be spaced a minimum of 6 inches from all pipes, ducts, conduits and equipment that are not braced for horizontal forces, unless approved otherwise by the building official.*
6. ***[OSHPD 1 & 4]*** *Acoustical tile or lay-in panel ceiling grids constructed of aluminum shall have the hanger spacing at 2 feet on center each way and total ceiling weight of such systems, W_p, shall not exceed 2 psf.*

1617A.1.22 ASCE 7, Section 13.5.7. [OSHPD 1 & 4] *Modify ASCE 7, Section 13.5.7, by the following:*

All access floors shall be special access floors in accordance with Section 13.5.7.2, except for raised roof or exterior floor paver systems.

1617A.1.23 ASCE 7, Section 13.6.2.1. [OSHPD 1 & 4] *Modify ASCE 7 Section 13.6.2.1 by adding the following to the end of the section:*

Use of this section shall be considered as an alternative system. Alternatively, HVACR systems shall require special seismic certification in accordance with Section 1705A.14.3 of this code.

1617A.1.24 ASCE 7, Section 13.6.5. *Replace ASCE 7, Section 13.6.5 as follows:*

13.6.5 Distribution Systems: Conduit, Cable Tray and Raceways. Cable trays and raceways shall be designed for seismic forces and seismic relative displacements as required in Section 13.3. Conduit *equal to or* greater than 2.5 inches (64 mm) trade size and attached to panels, cabinets or other equipment subject to seismic relative displacement, D_{pl}, shall be provided with flexible connections or designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions:

1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for raceways where flexible connections or other assemblies are provided between the cable tray or raceway and associated components to accommodate the relative displacement, where the cable tray or raceway is positively attached to the structure, and one of the following apply:
   a. Trapeze assemblies with $^3/_8$ inch (10 mm) or $^1/_2$ inch (13-mm) in diameter rod hangers not exceeding 12 inches (305 mm) in length from the conduit, cable tray or raceway support point to the connection at the supporting structure are used to support the cable tray or raceway, and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or
   b. The conduit, cable tray or raceway is supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the raceway run is 12 inches (305 mm) or less in length from the conduit, cable tray or raceway support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.
2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for conduit, regardless of the value of I_p, where the conduit is less than 2.5 inches (64 mm) trade size.

Design for the displacements across seismic joints shall be required for conduit, cable trays and raceways with $I_p = 1.5$ without consideration of conduit size.

1617A.1.25 ASCE 7, Section 13.6.6. *Replace ASCE 7, Section 13.6.6 with the following:*

13.6.6 Distribution Systems: Duct Systems. HVACR and other duct systems shall be designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions: The following exceptions pertain to *ductwork* not designed to carry toxic, highly toxic or flammable gases or not used for smoke control:

1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for duct systems where flexible connections or other assemblies are provided to accommodate the relative displacement between

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the duct system and associated components, the duct system is positively attached to the structure, and where one of the following apply:

a. Trapeze assemblies with $^3/_8$-inch (10 mm) *or $^1/_2$-inch (13 mm)* diameter rod hangers not exceeding 12 inches (305 mm) in length from the duct support point to the connection at the supporting structure are used to support duct, and the total weight supported by any single trapeze is *less than 10 lb/ft (146 N/m) and* 100 pounds or less; or

b. The duct is supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the duct run is 12 inches (305 mm) or less in length from the duct support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required where provisions are made to avoid impact with other ducts or mechanical components or to protect the ducts in the event of such impact, the distribution system is positively attached to the structure; and HVACR ducts have a cross-sectional area of less than 6 square feet (0.557 m^2) and weigh 20 lb/ft (292 N/m) or less.

Components that are installed in line with the duct system and have an operating weight greater than 75 pounds (334 N), such as fans, terminal units, heat exchangers and humidifiers, shall be supported and laterally braced independent of the duct system, and such braces shall meet the force requirements of Section 13.3.1. Components that are installed in line with the duct system, have an operating weight of 75 pounds (334 N) or less, such as small terminal units, dampers, louvers and diffusers, and are otherwise not independently braced shall be positively attached with mechanical fasteners to the rigid duct on both sides. Piping and conduit attached to in-line equipment shall be provided with adequate flexibility to accommodate the seismic relative displacements of Section 13.3.2.

1617A.1.26 ASCE 7, Section 13.6.7.3. *Replace ASCE 7, Section 13.6.7.3 with the following:*

13.6.7.3 Additional Provisions for Piping and Tubing Systems.

A) Design for the seismic forces of Section 13.3 shall not be required for piping systems where flexible connections, expansion loops or other assemblies are provided to accommodate the relative displacement between component and piping, where the piping system is positively attached to the structure, and where *any* of the following conditions apply:

1. Trapeze assemblies are supported by $^3/_8$-inch (10 mm) or $^1/_2$-inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the pipe support point to the connection at the supporting structure, and no single pipe exceeds the diameter limits set forth in item *2b below or 2 inches (50 mm) where I_p is greater than 1.0* and the total weight supported by any single trapeze is 100 pounds (445 N) or less; *or*

2. Piping is supported by rod hangers and provisions are made to avoid impact with other structural or nonstructural components or to protect the piping in the event of such impact; or pipes are supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, where each hanger in the pipe run is 12 inches (305 mm) or less in length from the pipe support point to the connection at the supporting structure, and the total weight supported by any single hanger is 50 pounds (220 N) or less. In addition, the following limitations on the size of piping shall be observed:

a. In structures assigned to Seismic Design Category D, E or F where I_p is greater than 1.0, the nominal pipe size shall be 1 inch (25 mm) or less.

b. In structures assigned to Seismic Design Category D, E or F where I_p = 1.0, the nominal pipe size shall be 3 inches (80 mm) or less.

3. Pneumatic tube systems supported with trapeze assemblies using $^3/_8$ inch (10 mm) in diameter rod hangers not exceeding 12 inches (305 mm) in length from the tube support point to the connection at the supporting structure and the total weight supported by any single trapeze is 100 pounds (445 N) or less.

4. Pneumatic tube systems supported by individual rod hangers $^3/_8$ inch (10 mm) or $^1/_2$ inch (13 mm) in diameter, and each hanger in the run is 12 inches (305 mm) or less in length from the tube support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

B) Flexible connections in piping required in Section 13.6.7.3 are not required where pipe is rigidly attached to the same floor or wall that provides vertical and lateral support for the equipment, or to a fixture.

C) Flexible connections in piping are required at seismic separation joints and shall be detailed to accommodate the seismic relative displacements at connections.

1617A.1.27 ASCE 7, Section 13.6.11.1. *Modify ASCE 7, Section 13.6.11.1, by adding Section 13.6.11.1.1 as follows:*

13.6.11.1.1 Elevators guide rail support. *The design of guide rail support-bracket fastenings and the supporting structural framing shall use the weight of the counterweight or maximum weight of the car plus not less than 40 percent of its rated load. The seismic forces shall be assumed to be distributed one third to the top guiding members and two thirds to the bottom guiding members of cars and counterweights, unless other substantiating data are provided. In addition to the requirements of ASCE 7, Section 13.6.11.1, the minimum seismic forces shall be 0.5g allowable stress design load acting in any horizontal direction.*

1617A.1.28 ASCE 7, Section 13.6.11.4. *Replace ASCE 7, Section 13.6.11.4, as follows:*

13.6.11.4 Retainer plates. Retainer plates are required at the top and bottom of the car and counterweight, *except where safety devices acceptable to the enforcement agency are provided which meet all requirements of the retainer plates, including*

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full engagement of the machined portion of the rail. The design of the car, cab stabilizers, counterweight guide rails and counterweight frames for seismic forces shall be based on the following requirements:

1. *The seismic force shall be computed per the requirements of ASCE 7, Section 13.6.11.1. The minimum horizontal acceleration shall be 0.5g allowable stress design load for all buildings.*
2. *W_p shall equal the weight of the counterweight or the maximum weight of the car plus not less than 40 percent of its rated load.*
3. *With the car or counterweight located in the most adverse position, the stress in the rail shall not exceed the limitations specified in these regulations, nor shall the deflection of the rail relative to its supports exceed the deflection listed below:*

RAIL SIZE (weight per foot of length, pounds)	WIDTH OF MACHINED SURFACE (inches)	ALLOWABLE RAIL DEFLECTION (inches)
8	$1^1/_4$	0.20
11	$1^1/_2$	0.30
12	$1^3/_4$	0.40
15	$1^{31}/_{32}$	0.50
$18^1/_2$	$1^{31}/_{32}$	0.50
$22^1/_2$	2	0.50
30	$2^1/_4$	0.50

For SI: 1 inch = 25 mm, 1 foot = 305 mm, 1 pound = 0.454 kg.
Note: Deflection limitations are given to maintain a consistent factor of safety against disengagement of retainer plates from the guide rails during an earthquake.

4. *Where guide rails are continuous over supports and rail joints are within 2 feet (610 mm) of their supporting brackets, a simple span may be assumed.*
5. *The use of spreader brackets is allowed.*
6. *Cab stabilizers and counterweight frames shall be designed to withstand computed lateral load with a minimum horizontal acceleration of 0.5g allowable stress design load.*

1617A.1.29 Reserved.

1617A.1.30 Reserved.

1617A.1.31 Reserved.

1617A.1.32 Reserved.

1617A.1.33 Reserved.

1617A.1.34 Reserved.

1617A.1.35 ASCE 7, Section 17.2.4.7. *Modify ASCE 7, Section 17.2.4.7, by adding the following:*

The effects of uplift shall be explicitly accounted for in the testing of the isolator units.

1617A.1.36 ASCE 7, Section 17.4. *Modify ASCE 7, Section 17.4.2, by adding the following:*

17.4.2.3 Linear procedures. *Linear procedures shall not be used in Seismic Design Category E & F structures.*

1617A.1.37 ASCE 7, Section 18.3. *Replace exception to ASCE 7, Section 18.3 with the following:*

Exception: *If the calculated force in an element of the seismic force-resisting system does not exceed 1.5 times its nominal strength for the Risk-Targeted Maximum Considered Earthquake (MCE_R) the element is permitted to be modeled as linear. For this section, the MCE_R response shall be based on largest response due to a single ground motion and not the average response of suite of ground motions.*

1617A.1.38 ASCE 7, Section 20.3. [OSHPD 1 & 4] *Modify ASCE 7 Section 20.3 by the following:*

Use of this section for new buildings with ground floor area larger than 4,000 square feet (371 m^2) shall be considered as an alternative system.

1617A.1.39 Earthquake Motion Measuring Instrumentation and Post-earthquake Structural Monitoring/Verification. [OSHPD 1 & 4] *Modify ASCE 7 by the following:*

Scope: *For buildings with a seismic isolation system, a damping system or a lateral force-resisting system (LFRS) not listed in ASCE 7, Table 12.2-1, earthquake motion measuring instrumentation and monitoring shall be required. For buildings with welded steel moment frames constructed under a permit issued prior to October 25, 1994 post-earthquake verification shall be in accordance with this section.*

Instrumentation: *Earthquake monitoring instrumentation shall be installed in accordance with Section 104.2.3.8.*

Monitoring: *After every significant seismic event, where the ground shaking acceleration at the site exceeds 0.3g or the acceleration at any monitored building level exceeds 0.8g as measured by the seismic monitoring system in the building, the owner shall retain a structural engineer to make an inspection of the structural system. The inspection shall include viewing the performance of the building, reviewing the strong motion records, and a visual examination of the isolators, dampers and connections for dete-*

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rioration, offset or physical damage. A report for each inspection, including conclusions on the continuing adequacy of the structural system, shall be submitted to the enforcement agency.

Verification: *After every seismic event that generates ground motions specified in the California Administrative Code, Chapter 6, Section 4.2.0.1 or the damage indicators specified in the California Administrative Code, Chapter 6, Section 4.2.0.2 at a welded steel moment frame building constructed under a permit issued prior to October 25, 1994, the owner shall retain a structural engineer to perform detailed joint evaluations required to meet the following requirements:*

1. *A detailed joint evaluation program shall be submitted to the enforcement agency for approval prepared in accordance with the requirements of the California Administrative Code, Chapter 6, Section 4.2.0.3.*
2. *Upon approval of the joint evaluation program required by Item 1 above for the joint inspections, a project to perform the joint inspections, detailed in the program, shall be submitted and a building permit shall be obtained by the owner no later than 6 months from the date of occurrence of the seismic event.*

   Exception: *Where the ground motions at the building site are less than 0.4g, the permit shall be obtained no later than 12 months from the date of occurrence of the seismic event.*
3. *A detailed joint evaluation report shall be submitted to the enforcement agency no later than 6 months of obtaining the building permit. The report shall document the findings from the inspections of the joints and include conclusions on the adequacy of the structural system. Where unsafe conditions are discovered, the provisions of Section 116 shall apply.*

Where the detailed joint evaluation report is not submitted within the timeframes specified above, the building shall not be issued a building permit for any projects except for those for seismic compliance, maintenance and repair until the detailed joint evaluation work is complete.

1617A.1.40 Operational nonstructural performance level requirements. [OSHPD 1 & 4] *New general acute care hospitals and new building(s) required for general acute care services shall satisfy Operational Nonstructural Performance Level (NPC-5) requirements.*

Exception: *A new building which is required for general acute care services that is added to an existing general acute care hospital and which has a building area of 4,000 square feet (371 m^2) or less, need not satisfy the NPC-5 requirements until the deadline specified in California Administrative Code (Part 1, Title 24 CCR), Chapter 6.*

Hospitals and buildings designed and constructed to the provisions of this code for new construction shall be deemed to satisfy Operational Nonstructural Performance Level (NPC-5) requirements when:

1. *The facility has on-site supplies of water and holding tanks for sewage and liquid waste, sufficient to support 72 hours of emergency operations for the hospital or building, which are integrated into the building plumbing systems in accordance with the California Plumbing Code.*
2. *An on-site emergency system as defined in the California Electrical Code is incorporated into the building electrical system for critical care areas. Additionally, the system shall provide for radiological service and an onsite fuel supply for 72 hours of acute care operation.*

Emergency and standby generators shall not be located below the higher of the Design Flood Elevation (DFE) or Base Flood Elevation (BFE) plus two feet (BFE + 2 ft.) or 500 year flood elevation, whichever is higher, and shall be located at an elevation close to grade for easy accessibility from outside for maintenance.

1617A.1.41 Peer Review Requirements. [OSHPD 1, 1R, 2 & 5]

1. ***General.*** *Independent peer review is an objective technical review by knowledgeable reviewer(s) experienced in structural design, analysis and performance issues involved. The reviewer(s) shall examine the available information on the condition of the building, basic engineering concept employed and recommendations for action.*

   Exception: *OSHPD may perform the work of peer review when qualified staff is available.*
2. ***Timing of Independent Review.*** *The independent reviewer (s) shall be selected prior to initiation of substantial portion of the design and analysis work that is to be reviewed, and review shall start as soon as practical and sufficient information defining the project is available.*
3. ***Qualifications and Terms of Employment.*** *The reviewer shall be independent from the design and construction team.*
   - *3.1. The reviewer(s) shall have no other involvement in the project before, during or after the review, except in a review capacity.*
   - *3.2. The reviewer shall be selected and paid by owner and shall have technical expertise similar to the project being reviewed, as determined by enforcement agent.*
   - *3.3. The reviewer (in case of review team, the chair) shall be a California-licensed structural engineer who is familiar with technical issues and regulations governing the work to be reviewed.*
   - *3.4. The reviewer shall serve through completion of the project and shall not be terminated except for failure to perform the duties specified herein. Such termination shall be in writing with copies to enforcement agent, owner and the engineer of record. When a reviewer is terminated or resigns, a qualified replacement shall be appointed within 10 working days or a timeframe mutually agreed to by the Owner, Registered Design Professional (RDP) and the Office.*
4. ***Scope of Review.*** *Review activities shall include, where appropriate, available construction documents, design criteria, observation of the condition of structure, all new and original inspection reports, including methods of sampling, analyses prepared by the engineer of record and consultants, and the new, retrofit or repair design. Review shall include consideration of the proposed design approach, method, materials and details.*

5. ***Reports.*** *The reviewer(s) shall prepare a written report to the owner and responsible enforcement agent that covers all aspect of the review performed including conclusions reached by the reviewer. Report shall be issued after the schematic phase, during design development, and at the completion of construction documents, but prior to their issuance of permit. Such report shall include, at the minimum, statement of the following:*

a. Scope of engineering design peer review with limitations defined.

b. The status of the project documents at each review stage.

c. Ability of selected materials and framing systems to meet the performance criteria with given loads and configuration.

d. Degree of structural system redundancy and the deformation compatibility among structural and nonstructural elements.

e. Basic constructability of the new, retrofit or repair system.

f. Other recommendation that will be appropriate for the specific project.

g. Presentation of the conclusions of the reviewer identifying any areas that need further review, investigation and/or clarification.

h. Recommendations.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter													X			X								
Adopt entire chapter as amended (amended sections listed below)	X			X	X						X	X			X									
Adopt only those sections that are listed below			X																					
Chapter / Section																								
1701			X																					
1701.1.1											X	X			X									
1701.1.2											X	X			X									
1701.1.3											X	X			X									
1702			X																					
1703			X																					
1703.4											X	X			X									
1704.2				X	X						X	X			X									
1704.2.3											X	X			X									
1704.2.4											X	X			X									
1704.2.5.1											X	X			X									
1704.3.2											X	X			X									
1705.1			X																					
1705.2.1											X	X			X									
1705.2.2											X	X			X									
1705.2.3											X	X			X									
1705.2.4.1											X	X			X									
1705.2.5.1											X	X			X									
1705.2.7											X	X			X									
1705.2.8											X	X			X									
1705.3			X								X	X			X									
Table 1705.3			X								X	X			X									
1705.3.3											X	X			X									
1705.3.3.1											X	X			X									
1705.3.4											X	X			X									
1705.3.5											X	X			X									
1705.3.6											X	X			X									
1705.3.7											X	X			X									
1705.3.8											X	X			X									
1705.3.9											X	X			X									
1705.3.9.1											X	X			X									
1705.3.9.2											X	X			X									
1705.4											X	X			X									
1705.4.1											X	X			X									
1705.4.1.1											X	X			X									
1705.5.3			X																					
Table 1705.5.3			X																					
1705.5.4											X	X			X									
1705.5.5											X	X			X									
1705.5.6											X	X			X									
1705.5.7											X	X			X									
1705.6.1											X	X			X									

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter													X			X								
Adopt entire chapter as amended (amended sections listed below)	X			X	X						X	X			X									
Adopt only those sections that are listed below			X																					
Chapter / Section																								
1705.7.1											X	X			X									
1705.12.1			X																					
1705.12.2			X																					
1705.13.1.1											X	X			X									
1705.13.1.2											X	X			X									
1705.13.2			X																					
1705.13.3			X																					
1705.14.1.1											X	X			X									
1705.14.1.2											X	X			X									
1705.14.2											X	X			X									
1705.14.3.1											X	X			X									
1705.15			X																					
1705.16			X																					
1705.18			X								X	X			X									
1705.19 – 1705.20			X																					
1707.1	X			X	X																			
1710											X	X			X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

17

SPECIAL INSPECTIONS AND TESTS

User notes:

About this chapter: Chapter 17 provides a variety of procedures and criteria for testing materials and assemblies, and labeling materials and assemblies. Its key purposes are to establish where additional inspections/observations and testing must be provided, and the submittals and verifications that must be provided to the building official. This chapter expands on the inspections of Chapter 1 by requiring special inspection by a qualified individual where indicated and, in some cases, structural observation by a registered design professional. Quality assurance measures that verify proper assembly of structural components and the suitability of the installed materials are intended to provide a building that, once constructed, complies with the minimum structural and fire-resistance code requirements as well as the approved design. To determine this compliance often requires frequent inspections and testing at specific stages of construction.

ICC code development note: Code change proposals to sections preceded by the designation [BF] will be considered by the IBC—Fire Safety Code Development Committee during the 2024 (Group A) Code Development Cycle. Sections preceded by the designation [F] will be considered by the International Fire Code Development Committee during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by the IBC—Structural Code Development Committee during the Group B cycle.

SECTION 1701—GENERAL

1701.1 Scope. The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

1701.1.1 Application. [OSHPD] *The scope of application of Chapter 17 is as follows:*

Structures regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD), which include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings as listed in Sections 1.10.1, 1.10.2 and 1.10.5.

1701.1.2 Amendments in this chapter. [OSHPD] *OSHPD adopts this chapter as amended.*

1701.1.3 Identification of amendments. [OSHPD 1R, 2 & 5] *Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:*

[OSHPD 1R] *– For applications listed in Section 1.10.1.*

[OSHPD 2] *– For applications listed in Section 1.10.2.*

[OSHPD 5] *– For applications listed in Section 1.10.5.*

SECTION 1702—NEW MATERIALS

1702.1 General. New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

SECTION 1703—APPROVALS

1703.1 Approved agency. An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements specified in Sections 1703.1.1 through 1703.1.3.

1703.1.1 Independence. An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall disclose to the building official and the registered design professional in responsible charge possible conflicts of interest so that objectivity can be confirmed.

1703.1.2 Equipment. An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

1703.1.3 Personnel. An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and special inspections.

1703.2 Written approval. Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

1703.3 Record of approval. For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be available for public review at appropriate times.

1703.4 Performance. Specific information consisting of test reports conducted by an approved agency in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the product, material or assembly meets the applicable code requirements.

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[OSHPD 1R, 2 & 5] Tests performed by an independent approved testing agency/laboratory or under the responsible charge of a competent approved independent Registered Design Professional shall be deemed to comply with requirements of this section. Test reports for structural tests shall be reviewed and accepted by an independent California licensed structural engineer.

1703.4.1 Research and investigation. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the product, material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the owner or the owner's authorized agent.

1703.4.2 Research reports. Supporting data, where necessary to assist in the approval of products, materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

1703.5 Labeling. Products, materials or assemblies required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703.5.1 through 1703.5.4.

1703.5.1 Testing. An approved agency shall test a representative sample of the product, material or assembly being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

1703.5.2 Inspection and identification. The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product, material or assembly is representative of the product, material or assembly tested.

1703.5.3 Label information. The label shall contain the manufacturer's identification, model number, serial number or definitive information describing the performance characteristics of the product, material or assembly and the approved agency's identification.

1703.5.4 Method of labeling. Information required to be permanently identified on the product, material or assembly shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

1703.6 Evaluation and follow-up inspection services. Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the owner or the owner's authorized agent shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

1703.6.1 Follow-up inspection. The owner or the owner's authorized agent shall provide for special inspections of fabricated items in accordance with Section 1704.2.5.

1703.6.2 Test and inspection records. Copies of necessary test and special inspection records shall be filed with the building official.

SECTION 1704—SPECIAL INSPECTIONS AND TESTS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATION

1704.1 General. Special inspections and tests, statements of special inspections, responsibilities of contractors, submittals to the building official and structural observations shall meet the applicable requirements of this section.

1704.2 Special inspections and tests. Where application is made to the building official for construction as specified in Section 105, *or 1.8.4, as applicable,* the owner or the owner's authorized agent, other than the contractor, shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705 and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building official that are identified in Section 110.

[OSHPD 1R, 2 & 5] In addition, the approved agencies shall provide special inspections and tests during construction on the types of work listed under Chapters 14, 15, 17, 18, 19, 20, 21, 22, 23, 24 and 25, and noted in the Test, Inspection and Observation (TIO) program as required by the Office.

The special inspectors shall act under the direction of the architect or structural engineer or both, and be responsible to the Owner. Where California Administrative Code Section 7-115 (a) 2 permits construction documents to be prepared under the responsible charge of a mechanical, electrical or civil engineer, special inspectors shall be permitted to work under the direction of an engineer in the appropriate branch as permitted therein.

Exceptions:

1. Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
2. Unless otherwise required by the building official, special inspections and tests are not required for Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.
3. Special inspections and tests are not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2206.1.2 or the conventional light-frame construction provisions of Section 2308. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

4. The contractor is permitted to employ the approved agencies where the contractor is also the owner. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*
5. ***[HCD 1]*** *The provisions of Health and Safety Code Division 13, Part 6 and the California Code of Regulations, Title 25, Division 1, Chapter 3, commencing with Section 3000, shall apply to the construction and inspection of factory-built housing as defined in Health and Safety Code Section 19971.*

1704.2.1 Special inspector qualifications. Prior to the start of the construction, the approved agencies shall provide written documentation to the building official demonstrating the competence and relevant experience or training of the special inspectors who will perform the special inspections and tests during construction. Experience or training shall be considered to be relevant where the documented experience or training is related in complexity to the same type of special inspection or testing activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as an approved agency and their personnel are permitted to act as special inspectors for the work designed by them, provided they qualify as special inspectors.

1704.2.2 Access for special inspection. The construction or work for which special inspection or testing is required shall remain accessible and exposed for special inspection or testing purposes until completion of the required special inspections or tests.

1704.2.3 Statement of special inspections. The applicant shall submit a statement of special inspections in accordance with Section 107.1 as a condition for permit issuance. This statement shall be in accordance with Section 1704.3. <

Exception: A statement of special inspections is not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2206.1.2 or the conventional light-frame construction provisions of Section 2308. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

1704.2.4 Report requirement. Approved agencies shall keep records of special inspections and tests. The approved agency shall submit reports of special inspections and tests to the building official and to the registered design professional in responsible charge at frequencies required by the approved construction documents or building official. All reports shall describe the nature and extent of inspections and tests, the location where the inspections and tests were performed, and indicate that work inspected or tested was or was not completed in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the building official. ***[OSHPD 1R, 2 & 5]*** *Report requirement shall be per 1704A.2.4.*

1704.2.5 Special inspection of fabricated items. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspections of the fabricated items shall be performed during fabrication, except where the fabricator has been approved to perform work without special inspections in accordance with Section 1704.2.5.1.

1704.2.5.1 Fabricator approval. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Special inspections during fabrication are not required where the work is done on the premises of a fabricator approved to perform such work without special inspection. Approval shall be based on review of the fabricator's written fabrication procedures and quality control manuals that provide a basis for control of materials and workmanship, with periodic auditing of fabrication and quality control practices by an approved agency or the building official. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704.5 stating that the work was performed in accordance with the approved construction documents.

1704.3 Statement of special inspections. Where special inspections or tests are required by Section 1705, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

Exception: The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

1704.3.1 Content of statement of special inspections. The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have special inspections or tests by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspections or tests for seismic or wind resistance as specified in Sections 1705.12, 1705.13 and 1705.14.
5. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the referenced standard where the inspections are defined.
6. Deferred submittal items that require a supplemental statement of special inspections.

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1704.3.2 Seismic requirements in the statement of special inspections. Where Section 1705.13 or 1705.14 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the designated seismic systems and seismic force-resisting systems that are subject to the special inspections or tests. ***[OSHPD 1R, 2 & 5]*** *Where Section 1705.13 or 1705.14 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the equipment/components that require special seismic certification and seismic force-resisting systems that are subject to the special inspection or tests.*

1704.3.3 Wind requirements in the statement of special inspections. Where Section 1705.12 specifies special inspection for wind resistance, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components that are subject to special inspections.

1704.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic force-resisting system, designated seismic system or a wind- or seismic force-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner or the owner's authorized agent prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspections.

1704.5 Submittals to the building official. In addition to the submittal of reports of special inspections and tests in accordance with Section 1704.2.4, reports and certificates shall be submitted by the owner or the owner's authorized agent to the building official for each of the following:

1. Certificates of compliance for the fabrication of structural, load-bearing or lateral load-resisting members or assemblies on the premises of an approved fabricator in accordance with Section 1704.2.5.1.
2. Certificates of compliance for the seismic qualification of nonstructural components, supports and attachments in accordance with Section 1705.14.2.
3. Certificates of compliance for designated seismic systems in accordance with Section 1705.14.3.
4. Reports of preconstruction tests for shotcrete in accordance with ACI 318.
5. Certificates of compliance for open web steel joists and joist girders in accordance with Section 2207.5.
6. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded.
7. Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category B, C, D, E or F.

1704.6 Structural observations. Where required by the provisions of Section 1704.6.1, the owner or the owner's authorized agent shall employ a registered design professional to perform structural observations. The structural observer shall visually observe representative locations of structural systems, details and load paths for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for the inspections in Section 110 or the special inspections in Section 1705 or other sections of this code. Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations. At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

1704.6.1 Structural observations for structures. Structural observations shall be provided for those structures where one or more of the following conditions exist:

1. The structure is classified as Risk Category III or IV.
2. The structure is a high-rise building.
3. The structure is assigned to Seismic Design Category E, and is greater than two stories above grade plane.
4. Such observation is required by the registered design professional responsible for the structural design.
5. Such observation is specifically required by the building official.

SECTION 1705—REQUIRED SPECIAL INSPECTIONS AND TESTS

1705.1 General. Special inspections and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705.1.1 Special cases. Special inspections and tests shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

1705.2 Steel construction. The special inspections and nondestructive testing of steel construction in buildings, structures and portions thereof shall be in accordance with this section.

Exception: Special inspections of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements where required by the approved construction documents.

1705.2.1 Structural steel. Special inspections and nondestructive testing of structural steel elements in buildings, structures and portions thereof shall be in accordance with the quality assurance inspection requirements of AISC 360. ***[OSHPD 1R, 2 & 5]*** *and this code.*

Exception: Special inspection of railing systems composed of structural steel elements shall be limited to welding inspection of welds at the base of cantilevered rail posts.

[OSHPD 1R, 2 & 5] *The following provisions of AISC 360, Chapter N are not permitted:*

1. *N5, Item 3 (Coordinated Inspection).*
2. *N6 (Approved Fabricators and Erectors).*

Notes: [OSHPD 1R, 2 & 5]

1. *Quality assurance requirements in AISC 360, AISC 341, AISC 358, AISO S240, SDI QA/QC and AISC 370 are equivalent to special inspection and testing requirements in this code and are provided by approved agencies employed by the Owner.*
2. *Chapter 22 requires the steel fabrication and erection, including quality control, to be in accordance with the AISC 360, AISC 341, AISC 358, AISI S240, SDI QA/QC and AISC 370.*

1705.2.2 Structural stainless steel. Special inspections and nondestructive testing of structural stainless steel elements in buildings and portions thereof shall be in accordance with the quality assurance inspection requirements of AISC 370. ***[OSHPD 1R, 2 & 5]*** *and this code.*

[OSHPD 1R, 2 & 5] *The following provisions of AISC 370, Chapter N are not permitted:*

1. *N5, Item 3. (Coordinated Inspection).*
2. *N6 (Approved Fabricators and Erectors).*

1705.2.3 Cold-formed steel deck. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck shall be in accordance with the quality assurance inspection requirements of SDI QA/QC. ***[OSHPD 1R, 2 & 5]*** *and this code.*

[OSHPD 1R, 2 & 5] *SDI QA/QC Section D3 (Coordinated Inspection) is not permitted.*

1705.2.4 Open-web steel joists and joist girders. Special inspections of open-web steel joists and joist girders in buildings, structures and portions thereof shall be in accordance with Table 1705.2.4.

TABLE 1705.2.4—REQUIRED SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]
1. Installation of open-web steel joists and joist girders.			
a. End connections – welding or bolted.	—	X	SJI specifications listed in Section 2207.1.
b. Bridging – horizontal or diagonal.	—	—	—
1. Standard bridging.	—	X	SJI specifications listed in Section 2207.1.
2. Bridging that differs from the SJI specifications listed in Section 2207.1.	—	X	—

a. Where applicable, see Section 1705.13.

1705.2.4.1 Steel joist and joist girder inspection. [OSHPD 1R, 2 & 5] *Special inspection is required during the manufacture and welding of steel joists or joist girders. The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected joist or joist girder. This mark or tag shall remain on the joist or joist girder throughout the job site receiving and erection process.*

1705.2.5 Cold-formed steel trusses spanning 60 feet or greater. Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

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1705.2.5.1 Light-framed steel truss inspection and testing. [OSHPD 1R, 2 & 5] *Regardless of truss span, the manufacture of cold-formed light-framed steel trusses shall be continuously inspected by an approved agency. The approved agency shall verify conformance of materials and manufacture with approved construction documents. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected truss. This mark or tag shall remain on the truss throughout the job site receiving and erection process. Refer to Section 2206.1.3.3 for requirements applicable to manufactured trusses specified therein.*

1705.2.6 Metal building systems. Special inspections of metal building systems shall be performed in accordance with Sections 1705.2.1, 1705.2.3, 1705.2.4 and 1705.2.5 and Table 1705.2.6. The approved agency shall perform inspections of the erected metal building system to verify compliance with the approved construction documents.

TABLE 1705.2.6—SPECIAL INSPECTIONS OF METAL BUILDING SYSTEMS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Installation of rafter/beam flange braces and column flange braces.	—	X
2. Installation of purlins and girts, including specified lapping.	—	X
3. Purlin and girt restraint/bridging/bracing.	—	X
4. Installation of X-bracing, tightened to remove any sag.	—	X

1705.2.7 Special inspection and tests of structural welding. [OSHPD 1R, 2 & 5] *Special inspections and testing (including nondestructive testing) of all shop and field welding operations shall be in accordance with this section and Sections 1705.2.1, 1705.2.2, 1705.13.1, and 1705.14.1, as applicable. Special inspections shall be performed by an approved welding inspector. The minimum requirements for a qualified welding special inspector shall be as those for an AWS Certified Welding Inspector (CWI), as defined in the provisions of the AWS QC1 or AWS B5.1.*

The welding inspector shall make a systematic daily record of all welds. This record shall include:

1. *Identification marks of welders.*
2. *List of defective welds.*
3. *Manner of correction of defects.*

The welding inspector shall check the material, details of construction and procedure, as well as workmanship of the welds. The special inspector shall verify that the installation of end-welded stud shear connectors are in accordance with the requirements of Section 2216.2 and the approved construction documents. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding has been done in conformance with AWS D1.1, D1.3, D1.4, D1.6, D1.8, and the approved construction documents.

1705.2.8 Special inspection and tests of high-strength fastener assemblies. [OSHPD 1R, 2 & 5] *Special inspections and tests for high-strength fasteners shall be in accordance with this section and Section 2216.1.*

1705.3 Concrete construction. Special inspections and tests of concrete construction shall be performed in accordance with this section and Table 1705.3.

Exceptions: Special inspections and tests shall not be required for: ***[OSHPD 1R, 2 & 5]*** *Exceptions 1 through 4 are not permitted by OSHPD.*

1. Isolated spread concrete footings of buildings three stories or less above grade plane that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above grade plane that are fully supported on earth or rock where:
   2.1. The footings support walls of light-frame construction.
   2.2. The footings are designed in accordance with Table 1809.7.
   2.3. The structural design of the footing is based on a specified compressive strength, f'_c, not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the approved construction documents or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.

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TABLE 1705.3—REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

	TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	*CBC* REFERENCE
1.	Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	—
2.	Reinforcing bar welding:				—
	a. Verify weldability of reinforcing bars other than ASTM A706.	—	X	AWS D1.4 ACI 318: 26.13.1.4	
	b. Inspect welding of reinforcement for special moment frames, boundary elements of special structural walls and coupling beams.	X	—	AWS D1.4 ACI 318: 26.13.3	
	c. Inspect welded reinforcement splices.	X	—	—	
	d. Inspect welding of primary tension reinforcement in corbels.	X	—	—	
	e. Inspect single-pass fillet welds, maximum $^{5}/_{16}$".	—	X	AWS D1.4 ACI 318: 26.13.3	
	f. Inspect all other welds.	—	X	AWS D1.4 ACI 318: 26.13.3	
3.	Inspect anchors cast in concrete.	—	X	ACI 318: 26.13.3.3	—
4.	Inspect anchors post-installed in hardened concrete members:[b]				—
	a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.[c]	X	—	ACI 318: 26.13.3.2	
	b. Mechanical anchors and adhesive anchors not defined in 4.a.	—	X	ACI 318: 26.13.3	
5.	Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2
6.	Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C31 ASTM C172 ACI 318: 26.5, 26.12	—
7.	Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	—
8.	Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	—
9.	Inspect prestressed concrete for:				—
	a. Application of prestressing forces.	X	—	ACI 318: 26.10	
	b. Grouting of bonded prestressing tendons.	X	—		
10.	Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11.	For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspect such connections and reinforcement in the field for:			ACI 318: 26.13.1.3 ACI 550.5	—
	a. Installation of the embedded parts.	X	—		
	b. Completion of the continuity of reinforcement across joints.	X	—		
	c. Completion of connections in the field.	X	—		
12.	Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	—	X	ACI 318: 26.13.1.3	—
13.	Verify in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
14.	Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705.13.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 26.13 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

c. ***[OSHPD 1R, 2 & 5]*** *Installation of all adhesive anchors in horizontal and upwardly inclined positions shall be performed by an ACI/CRSI Certified Adhesive Anchor Installer, except where the factored design tension on the anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents or where the anchors are shear dowels across cold joints in slabs on grade where the slab is not part of the lateral force-resisting system.*

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1705.3.1 Welding of reinforcing bars. Special inspections of welding and qualifications of special inspectors for reinforcing bars shall be in accordance with the requirements of AWS D1.4 for special inspection and of AWS D1.4 for special inspector qualification.

1705.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19 and 20 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19 and 20 of ACI 318.

1705.3.3 Batch plant inspection. [OSHPD 1R, 2 & 5] *Except as provided under this section, the quality and quantity of materials used in transit-mixed concrete and in batched aggregates shall be continuously inspected by an approved agency at the location where materials are measured.*

> ***1705.3.3.1 Waiver of continuous batch plant inspection.*** *Continuous batch plant inspection shall be permitted to be waived by the registered design professional, subject to approval by the enforcement agency under either of the following conditions:*

A. The concrete plant complies fully with the requirements of ASTM C94, Sections 9 and 10, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the enforcement agency. The certification shall indicate that the plant has automatic batching and recording capabilities.

B. For single-story light-framed construction (without basement or retaining walls higher than 6 feet in height measured from bottom of footing to top of wall) and isolated foundations supporting equipment only, where deep foundation elements are not used.

When continuous batch plant inspection is waived, the following requirements shall apply and shall be described in the construction documents:

1. *An approved agency shall check the first batch at the start of the day to verify materials and proportions conform to the approved mix design.*
2. *A licensed weighmaster shall positively identify quantity of materials and certify each load by a batch ticket.*
3. *Batch tickets, including material quantities and weights, shall accompany the load, shall be transmitted to the inspector of record by the truck driver with load identified thereon. The load shall not be placed without a batch ticket identifying the mix. The inspector of record shall keep a daily record of placements, identifying each truck, its load, time of receipt at the job site and approximate location of deposit in the structure and shall maintain a copy of the daily record as required by the enforcement agency.*

1705.3.4 Inspection and testing of prestressed concrete. [OSHPD 1R, 2 & 5] *Inspections and tests for prestressed concrete work shall be in accordance with this section. Tests for prestressing steel and anchorage shall be in accordance with Section 1910A.3. Inspection shall be in accordance with the following:*

1. *In addition to the general inspection required for concrete work, all plant fabrication of prestressed concrete members or tensioning of post-tensioned members constructed at the site shall be continuously inspected by an approved special inspector.*

   Exception: *The special inspector need not be continuously present for the placement of prestress or post-tensioned cables or tendons.*
2. *The prestressed concrete plant fabrication special inspector shall check the materials, equipment, tensioning procedure and construction of the prestressed members and prepare daily written reports. The approved agency shall make a verified report identifying the members by mark and shall include such pertinent data as lot numbers of tendons used, tendon jacking forces, age and strength of concrete at time of tendon release and such other information that may be required.*
3. *The special inspector of prestressed members post-tensioned at the site shall check the condition of the prestressing tendons, anchorage assemblies and concrete in the area of the anchorage, the tensioning equipment and the tensioning procedure and prepare daily written reports. The approved agency shall make a verified report of the prestressing operation identifying the members or tendons by mark and including such pertinent data as the initial cable slack, net elongation of tendons, jacking force developed and such other information as may be required.*
4. *The verified reports of construction shall show that of the special inspector's own personal knowledge, the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved construction documents for plant fabrication inspection. The verified report shall be accompanied by test reports required for materials used. For site post-tensioning special inspections, the verified report shall be accompanied by copies of calibration charts, certified by an approved testing laboratory, showing the relationship between gage readings and force applied by the jacks used in the prestressing procedure*

1705.3.5 Concrete pre-placement inspection. [OSHPD 1R, 2 & 5] *Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the Inspector of Record.*

1705.3.6 Placing record. [OSHPD 1R, 2 & 5] *A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the enforcement agency.*

1705.3.7 Composite construction cores. [OSHPD 1R, 2 & 5] *Composite construction cores shall be taken and tested in accordance with Section 1910A.4.*

1705.3.8 Special Inspections and tests for post-installed anchors in concrete. [OSHPD 1R, 2 & 5] *Special inspections and tests for post-installed anchors in concrete shall be in accordance with Table 1705.3 and Section 1901.3.*

1705.3.9 Shotcrete. [OSHPD 1R, 2 & 5] *All shotcrete work shall be continuously inspected during placing by an approved agency. The shotcrete special inspector shall check the materials, placing equipment, details of construction and construction procedure. The approved agency shall furnish a verified report that of his or her own personal knowledge the work covered by the report has been performed and materials have been used and installed in every material respect in compliance with the duly approved construction documents.*

1705.3.9.1 Visual examination for structural soundness of in-place shotcrete. *Completed shotcrete work shall be checked visually for reinforcing bar embedment, voids, rock pockets, sand streaks and similar deficiencies by examining a minimum of three 3-inch (76 mm) cores taken from three areas chosen by the design engineer which represent the worst congestion of reinforcing bars occurring in the project. Extra reinforcing bars may be added to noncongested areas and cores may be taken from these areas. The cores shall be examined by the special inspector and a report submitted to the enforcement agency prior to final approval of the shotcrete.*

Exception: *Shotcrete work fully supported on earth, minor repairs, and when, in the opinion of the enforcement agency, no special hazard exists.*

1705.3.9.2 Preconstruction tests. *A shotcrete mockup panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The mockup panel shall be representative of the project and simulate job conditions as closely as possible. The mockup panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. Adequate encasement of bars larger than No. 5 shall be demonstrated by the mockup panels. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official. Reports of preconstruction tests shall be submitted to the building official as specified in Section 1704.5.*

1705.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602. ***[OSHPD 1R, 2 & 5]*** *as set forth in Tables 3 and 4, Level 3 requirements and Chapter 21. Testing shall be performed in accordance with Section 2105. Special inspection and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17 and 19. Batch plant inspection of grout materials shall be in accordance with Section 1705.3.3.*

Exception: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Special inspections and tests shall not be required for:

1. Glass unit masonry or masonry veneer designed in accordance with Section 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

1705.4.1 Glass unit masonry and masonry veneer in Risk Category IV. Special inspections and tests for glass unit masonry or masonry veneer designed in accordance with Section 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV shall be performed in accordance with TMS 602 Level 2. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

[OSHPD 1R, 2 & 5] Glass unit masonry and masonry veneer in Risk Category II, III or IV. *Special inspections and tests for glass unit masonry or masonry veneer designed by Section 2110 or Chapter 14, respectively, in structures classified as Risk Category II, III or IV, shall be performed in accordance with TMS 602 Tables 3 and 4, Level 2 Quality Assurance.*

1705.4.1.1 TMS 602 Section 1.6 Quality Assurance. [OSHPD 1R, 2 & 5] *Replace footnote (d) as follows: (d) Periodic special inspection is required for all veneer.*

1705.4.2 Vertical masonry foundation elements. Special inspections and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705.4.

1705.5 Wood construction. Special inspections of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704.2.5. Special inspections of site-built assemblies shall be in accordance with this section.

1705.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved construction documents. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved construction documents.

1705.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater. Where a truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705.5.3 Mass timber construction. Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

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TABLE 1705.5.3—REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION				
TYPE			CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		—	X
2.	Inspect erection of mass timber construction.		—	X
3.	Inspection of connections where installation methods are required to meet design loads.			
	Threaded fasteners.	Verify use of proper installation equipment.	—	X
		Verify use of pre-drilled holes where required.	—	X
		Inspect screws, including diameter, length, head type, spacing, installation angle and depth.	—	X
	Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.		X	—
	Adhesive anchors not defined in preceding cell.		—	X
	Bolted connections.		—	X
	Concealed connections.		—	X

1705.5.4 Manufactured trusses and assemblies. [OSHPD 1R, 2 & 5] *The fabrication of trusses and other assemblages constructed using wood and metal members, or using light metal plate connectors, shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report that the lumber species, grades and moisture content; type of glue, temperature and gluing procedure; type of metal members and metal plate connectors; and the workmanship conform in every material respect with the duly approved construction documents. Each inspected truss shall be stamped by the approved agency with an identifying mark.*

1705.5.5 Structural glued laminated and cross-laminated timber. [OSHPD 1R, 2 & 5] *Manufacture of all structural glued laminated and cross-laminated timber shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the approved agency with an identification mark.

Exception: *Special Inspection is not required for non-custom prismatic glued laminated members identified on drawings and sourced from stock or general inventory of $5^{1}/_{2}$-inch (140 mm) maximum width and 18-inch (457 mm) maximum depth, and with a maximum clear span of 32 feet (9754 mm), manufactured and marked in accordance with ANSI /APA A190.1 Section 14.1 for noncustom members.*

1705.5.6 Manufactured open web trusses. [OSHPD 1R, 2 & 5] *The manufacture of open web trusses shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected truss shall be stamped with an identification mark by the approved agency.

1705.5.7 Timber connectors. [OSHPD 1R, 2 & 5] *The installation of all split ring and shear plate timber connectors and timber rivets shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report verifying that the materials, timber connectors and workmanship conform to the approved construction documents.*

1705.6 Soils. Special inspections and tests of existing site soil conditions, fill placement and load-bearing requirements shall be performed in accordance with this section and Table 1705.6. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

Exception: Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557.

TABLE 1705.6—REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS		
TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X

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1705.6.1 Soil fill. [OSHPD 1R, 2 & 5] *All fills used to support the foundations of any building or structure shall be continuously inspected by the geotechnical engineer or his or her qualified representative. It shall be the responsibility of the geotechnical engineer to verify that fills meet the requirements of the approved construction documents and to coordinate all fill inspection and testing during construction involving such fills.*

The duties of the geotechnical engineer or his or her qualified representative shall include, but need not be limited to, the inspection of cleared areas and benches prepared to receive fill; inspection of the removal of all unsuitable soils and other materials; the approval of soils to be used as fill material; the inspection of placement and compaction of fill materials; the testing of the completed fills; and the inspection or review of geotechnical drainage devices, buttress fills or other similar protective measures in accordance with the approved construction documents.

A verified report shall be submitted by the geotechnical engineer as required by the California Administrative Code. The report shall indicate that all tests and inspections required by the approved construction documents were completed and whether the tested materials and/or inspected work meet the requirements of the approved construction documents.

1705.7 Driven deep foundations. Special inspections and tests shall be performed during installation of driven deep foundation elements as specified in Table 1705.7. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

TABLE 1705.7—REQUIRED SPECIAL INSPECTIONS AND TESTS OF DRIVEN DEEP FOUNDATION ELEMENTS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Inspect driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional special inspections in accordance with Section 1705.2.	In accordance with Section 1705.2	
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705.3.	In accordance with Section 1705.3	
7.For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	In accordance with Statement of Special Inspections	

1705.7.1 Driven deep foundations observation. [OSHPD 1R, 2 & 5] *The installation of driven deep foundations shall be continuously observed by a qualified representative of the geotechnical engineer responsible for that portion of the project.*

The representative of the geotechnical engineer shall make a report of the deep foundation pile-driving operation giving such pertinent data as the physical characteristics of the deep foundation pile-driving equipment, identifying marks for each deep foundation pile, total depth of embedment for each deep foundation; and when the allowable deep foundation pile loads are determined by a dynamic load formula, the design formula used, and the permanent penetration under the last 10 blows. One copy of the report shall be sent to the enforcement agency.

1705.8 Cast-in-place deep foundations. Special inspections and tests shall be performed during installation of cast-in-place deep foundation elements as specified in Table 1705.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

TABLE 1705.8—REQUIRED SPECIAL INSPECTIONS AND TESTS OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3.	In accordance with Section 1705.3	

1705.9 Helical pile foundations. Continuous special inspections shall be performed during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the registered design professional in responsible charge. The approved

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geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

1705.10 Structural integrity of deep foundation elements. Whenever there is a reasonable doubt as to the structural integrity of a deep foundation element, an engineering assessment shall be required. The engineering assessment shall include tests for defects performed in accordance with ASTM D4945, ASTM D5882, ASTM D6760 or ASTM D7949, or other approved method.

1705.11 Fabricated items. Special inspections of fabricated items shall be performed in accordance with Section 1704.2.5.

1705.12 Special inspections for wind resistance. Special inspections for wind resistance specified in Sections 1705.12.1 through 1705.12.3, unless exempted by the exceptions to Section 1704.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where basic wind speed, *V,* is 150 mph (67 m/sec) or greater.
2. In wind Exposure Category C or D, where basic wind speed, *V,* is 140 mph (62.6 m/sec) or greater.

1705.12.1 Structural wood. Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

Exception: Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the main windforce-resisting system, where the lateral resistance is provided by structural sheathing and the specified fastener spacing at panel edges is more than 4 inches (102 mm) on center.

1705.12.2 Cold-formed steel light-frame construction. Periodic special inspection is required for welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

Exception: Special inspections are not required for cold-formed steel light-frame shear walls and diaphragms, including screwing, bolting, anchoring and other fastening to components of the windforce-resisting system, where either of the following applies:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the specified fastener spacing at the panel or sheet edges is more than 4 inches (102 mm) on center (o.c.).

1705.12.3 Wind-resisting components. Periodic special inspection is required for fastening of the following systems and components:

1. Roof covering, roof deck and roof framing connections.
2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.

1705.13 Special inspections for seismic resistance. Special inspections for seismic resistance shall be required as specified in Sections 1705.13.1 through 1705.13.9, unless exempted by the exceptions of Section 1704.2.

Exception: The special inspections specified in Sections 1705.13.1 through 1705.13.9 are not required for structures designed and constructed in accordance with one of the following:

1. The structure consists of light-frame construction; the design spectral response acceleration at short periods, S_{DS}, as determined in Section 1613.2.4, does not exceed 0.5; and the building height of the structure does not exceed 35 feet (10 668 mm).
2. The seismic force-resisting system of the structure consists of reinforced masonry or reinforced concrete; the design spectral response acceleration at short periods, S_{DS}, as determined in Section 1613.2.4, does not exceed 0.5; and the building height of the structure does not exceed 25 feet (7620 mm).
3. The structure is a detached one- or two-family dwelling not exceeding two stories above grade plane and does not have any of the following horizontal or vertical irregularities in accordance with Section 12.3 of ASCE 7:
   3.1. Torsional or extreme torsional irregularity.
   3.2. Nonparallel systems irregularity.
   3.3. Stiffness-soft story or stiffness-extreme soft story irregularity.
   3.4. Discontinuity in lateral strength-weak story irregularity.

1705.13.1 Structural steel. Special inspections for seismic resistance shall be in accordance with Section 1705.13.1.1 or 1705.13.1.2, as applicable.

1705.13.1.1 Seismic force-resisting systems. Special inspections of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341. ***[OSHPD 1R, 2 & 5]*** *and this code.*

Exceptions: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, special inspections are not required for structural steel seismic force-resisting systems where the response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, has been used for design and detailing.

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2. In structures assigned to Seismic Design Category D, E, or F, special inspections are not required for structural steel seismic force-resisting systems where design and detailing in accordance with AISC 360 is permitted by ASCE 7, Table 15.4-1.

1705.13.1.2 Structural steel elements. Special inspections of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F other than those covered in Section 1705.13.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341. ***[OSHPD 1R, 2 & 5]*** *and this code.*

Exceptions: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, special inspections of structural steel elements are not required for seismic force-resisting systems with a response modification coefficient, R, of 3 or less.
2. In structures assigned to Seismic Design Category D, E, or F, special inspections of structural steel elements are not required for seismic force-resisting systems where design and detailing other than AISC 341 is permitted by ASCE 7, Table 15.4-1. Special inspection shall be in accordance with the applicable referenced standard listed in ASCE 7, Table 15.4-1.

1705.13.2 Structural wood. For the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F:

1. Continuous special inspection shall be required during field gluing operations of elements of the seismic force-resisting system.
2. Periodic special inspection shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

Exception: Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the seismic force-resisting system, where the lateral resistance is provided by structural sheathing, and the specified fastener spacing at the panel edges is more than 4 inches (102 mm) on center.

1705.13.3 Cold-formed steel light-frame construction. For the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F, periodic special inspection shall be required for both:

1. Welding operations of elements of the seismic force-resisting system.
2. Screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

Exception: Special inspections are not required for cold-formed steel light-frame shear walls and diaphragms, including screw installation, bolting, anchoring and other fastening to components of the seismic force-resisting system, where either of the following applies:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the specified fastener spacing at the panel or sheet edge is more than 4 inches (102 mm) on center.

1705.13.4 Designated seismic systems. For structures assigned to Seismic Design Category C, D, E or F, the special inspector shall examine designated seismic systems requiring seismic qualification in accordance with Section 13.2.3 of ASCE 7 and verify that the label, anchorage and mounting conform to the certificate of compliance.

1705.13.5 Architectural components. Periodic special inspection is required for the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

Exception: Periodic special inspection is not required for the following:

1. Exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer 30 feet (9144 mm) or less in height above grade or walking surface.
2. Exterior cladding and interior and exterior *veneer* weighing 5 psf (0.24 kN/m^2) or less.
3. Interior nonbearing walls weighing 15 psf (0.72 kN/m^2) or less.

1705.13.5.1 Access floors. Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

1705.13.6 Plumbing, mechanical and electrical components. Periodic special inspection of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to Seismic Design Category C, D, E or F.
2. Anchorage of other electrical equipment in structures assigned to Seismic Design Category E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category C, D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category C, D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where the approved construction documents require a nominal clearance of $^1/_4$ inch (6.4 mm) or less between the equipment support frame and restraint.

6. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic sprinkler systems are installed in structures assigned to Seismic Design Category C, D, E or F to verify one of the following:
   6.1. Minimum clearances have been provided as required by Section 13.2.4 ASCE/SEI 7.
   6.2. A nominal clearance of not less than 3 inches (76 mm) has been be provided between automatic sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.

Where flexible sprinkler hose fittings are used, special inspection of minimum clearances is not required.

1705.13.7 Storage racks. Steel storage racks and steel cantilevered storage racks that are 8 feet (2438 mm) in height or greater and assigned to Seismic Design Category D, E or F shall be provided with periodic special inspection as required by Table 1705.13.7.

TABLE 1705.13.7—REQUIRED INSPECTIONS OF STORAGE RACK SYSTEMS

TYPE	CONTINUOUS INSPECTION	PERIODIC INSPECTION	REFERENCED STANDARD	IBC REFERENCE
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	—	X	—	—
2. Fabricated storage rack elements.	—	X	—	Section 1704.2.5
3. Storage rack anchorage installation.	—	X	ANSI/MH16.1 Section 7.3.2	—
4. Completed storage rack system, to indicate compliance with the approved construction documents.	—	X	—	—

1705.13.8 Seismic isolation systems. Periodic special inspection shall be provided for seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B, C, D, E or F during the fabrication and installation of isolator units and energy dissipation devices.

1705.13.9 Cold-formed steel special bolted moment frames. Periodic special inspection shall be provided for the installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F.

1705.14 Testing for seismic resistance. Testing for seismic resistance shall be required as specified in Sections 1705.14.1 through 1705.14.4, unless exempted from special inspections by the exceptions of Section 1704.2.

1705.14.1 Structural steel. Nondestructive testing for seismic resistance shall be in accordance with Section 1705.14.1.1 or 1705.14.1.2, as applicable.

1705.14.1.1 Seismic force-resisting systems. Nondestructive testing of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341. ***[OSHPD 1R, 2 & 5]*** *and this code.*

Exceptions: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, nondestructive testing is not required for structural steel seismic force-resisting systems where the response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, has been used for design and detailing.
2. In structures assigned to Seismic Design Category D, E, or F, nondestructive testing is not required for structural steel seismic force-resisting systems where design and detailing in accordance with AISC 360 is permitted by ASCE 7, Table 15.4-1.

1705.14.1.2 Structural steel elements. Nondestructive testing of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F other than those covered in Section 1705.14.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341. ***[OSHPD 1R, 2 & 5]*** *and this code.*

Exceptions: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, nondestructive testing of structural steel elements is not required for seismic force-resisting systems with a response modification coefficient, R, of 3 or less.
2. In structures assigned to Seismic Design Category D, E or F, nondestructive testing of structural steel elements is not required for seismic force-resisting systems where design and detailing other than AISC 341 is permitted by ASCE 7, Table 15.4-1. Nondestructive testing of structural steel elements shall be in accordance with the applicable referenced standard listed in ASCE 7, Table 15.4-1.

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1705.14.2 Nonstructural components. For structures assigned to Seismic Design Category B, C, D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by seismic qualification as specified in Item 2 therein, the registered design professional shall specify on the approved construction documents the requirements for seismic qualification by analysis, testing or experience data. Certificates of compliance for the seismic qualification shall be submitted to the building official as specified in Section 1704.5.

[OSHPD 1R, 2 & 5] *Seismic sway bracing components satisfying requirements of ANSI/FM 1950, ANSI/ASHRAE 171, or using an alternative testing protocol approved by the building official shall be deemed to satisfy the requirements of this section.*

Note: *Deemed to comply provisions provide acceptable options to comply with the code but do not mandate their use. Alternative systems in accordance with Section 104.2.3 and the California Administrative Code Section 7-104 are always acceptable when approved by the building official.*

1705.14.3 Designated seismic systems. For structures assigned to Seismic Design Category C, D, E or F and with designated seismic systems that are subject to the requirements of Section 13.2.3 of ASCE 7 for certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis, testing or experience data as specified therein. Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704.5.

1705.14.3.1 Special seismic certification. [OSHPD 1R, 2 & 5] *Special seismic certification shall be required in accordance with Section 1705A.14.3. for all of the following:*

1. *Life-safety components, such as emergency and standby power systems, mechanical smoke removal systems and fire sprinkler/fire protection systems.*
2. *Medical, mechanical and electrical equipment and components required for life support for patients.*
3. *On-site power resources (PVs, batteries, fuel cells, etc.) provided to replace, in whole or in part, the public or private electric utility service.*
4. ***[OSHPD 2]*** *Alternate power systems including:*
   a. *Generators.*
   b. *UPS and batteries.*
   c. *Renewable electrical generation and control equipment.*
   d. *Panelboards as defined in the California Electrical Code (CEC) Article 100.*
   e. *Manual and automatic transfer switches.*
   f. *Switchgear and switchboards.*

1705.14.4 Seismic isolation systems. Seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B, C, D, E or F shall be tested in accordance with Section 17.8 of ASCE 7.

[BF] 1705.15 Sprayed fire-resistive materials (SFRM). Special inspections and tests of sprayed fire-resistive materials (SFRM) applied to floor, roof and wall assemblies and structural members shall be performed in accordance with Sections 1705.15.1 through 1705.15.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections and tests shall be performed during construction with an additional visual inspection after the rough installation of electrical, automatic sprinkler systems, mechanical and plumbing systems and suspension systems for ceilings, and before concealment where applicable. The required sample size shall not exceed 110 percent of that specified by the referenced standards in Sections 1705.15.4.1 through 1705.15.4.9.

[BF] 1705.15.1 Physical and visual tests. The special inspections and tests shall include the following to demonstrate compliance with the listing and the fire-resistance rating:

1. Condition of substrates.
2. Thickness of application.
3. Density in pounds per cubic foot (kg/m^3).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

[BF] 1705.15.2 Structural member surface conditions. The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected by the special inspector before the application of the SFRM.

[BF] 1705.15.3 Application. The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.

[BF] 1705.15.4 Thickness. Not more than 10 percent of the thickness measurements of the SFRM applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, and none shall be less than the minimum allowable thickness required by Section 1705.15.4.1.

[BF] 1705.15.4.1 Minimum allowable thickness. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus $^1/_4$ inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the

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minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E605. Samples of the SFRM shall be selected in accordance with Sections 1705.15.4.2 *through 1705.15.4.9.*

[BF] 1705.15.4.2 Floor, roof and wall assemblies. The thickness of the SFRM applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E605, making not less than four measurements for each 1,000 square feet (93 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705.15.4.3 Cellular decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area.

[BF] 1705.15.4.4 Fluted decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

[BF] 1705.15.4.5 Structural members. The thickness of the SFRM applied to structural members shall be determined in accordance with ASTM E605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

[BF] 1705.15.4.6 Beams and girders. At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.7 Joists and trusses. At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.8 Wide-flanged columns. At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.9 Hollow structural section and pipe columns. At hollow structural section and pipe columns, thickness measurements shall be made at not fewer than four locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705.15.5 Density. The density of the SFRM shall be not less than the density specified in the approved fire-resistance design. Density of the SFRM shall be determined in accordance with ASTM E605. The test samples for determining the density of the SFRM shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each story.

[BF] 1705.15.6 Bond strength. The cohesive/adhesive bond strength of the cured SFRM applied to floor, roof and wall assemblies and structural members shall be not less than 150 pounds per square foot (psf) (7.18 kN/m^2). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E736 by testing in-place samples of the SFRM selected in accordance with Sections 1705.15.6.1 through 1705.15.6.3.

[BF] 1705.15.6.1 Floor, roof and wall assemblies. The test samples for determining the cohesive/adhesive bond strength of the SFRM shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705.15.6.2 Structural members. The test samples for determining the cohesive/adhesive bond strength of the SFRM shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each story.

[BF] 1705.15.6.3 Primer, paint and encapsulant bond tests. Bond tests to qualify a primer, paint or encapsulant shall be conducted where the SFRM is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the SFRM has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

[BF] 1705.16 Intumescent fire-resistive materials. Special inspections and tests for intumescent fire-resistive materials applied to structural elements and decks shall be performed in accordance with AWCI 12-B. Special inspections and tests shall be based on the fire-resistance design as designated in the approved construction documents. Special inspections and tests shall be performed during construction. Additional visual inspection shall be performed after the rough installation and, where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

[BF] 1705.17 Exterior insulation and finish systems (EIFS). Special inspections shall be required for all EIFS applications.

Exceptions:

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.
2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

[BF] 1705.17.1 Water-resistive barrier coating. A water-resistive barrier coating complying with ASTM E2570 requires special inspection of the water-resistive barrier coating where installed over a sheathing substrate.

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[BF] 1705.18 Fire-resistant penetrations and joints. In high-rise buildings, in buildings assigned to Risk Category III or IV, or in fire areas containing Group R occupancies with an occupant load greater than 250, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire containment systems that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705.18.1 or 1705.18.2.

[OSHPD 1R, 2 & 5] *Buildings assigned to all Risk Categories shall be subject to special inspections for fire-resistant penetrations and joints.*

[BF] 1705.18.1 Penetration firestops. Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.4.1.2 and 714.5.1.2 shall be conducted by an approved agency in accordance with ASTM E2174.

[BF] 1705.18.2 Fire-resistant joint systems. Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3.1 and 715.4 shall be conducted by an approved agency in accordance with ASTM E2393.

[F] 1705.19 Testing for smoke control. Smoke control systems shall be tested by a special inspector.

[F] 1705.19.1 Testing scope. The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.

[F] 1705.19.2 Qualifications. Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

1705.20 Sealing of mass timber. Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to mass timber building elements as designated in the approved construction documents.

SECTION 1706—DESIGN STRENGTHS OF MATERIALS

1706.1 Conformance to standards. The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

1706.2 New materials. For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707.

SECTION 1707—ALTERNATIVE TEST PROCEDURE

1707.1 General. In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.2.3 *or 1.8.7, as applicable.* The cost of all tests and other investigations required under the provisions of this code shall be borne by the owner or the owner's authorized agent.

[BSC] *In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 1.2.1, Chapter 1, Division I. The cost of all tests and other investigations required under the provisions of this code shall be borne by the applicant.*

SECTION 1708—IN-SITU LOAD TESTS

1708.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. The in-situ load tests shall be conducted in accordance with Section 1708.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1708.2 In-situ load tests. In-situ load tests shall be conducted in accordance with Section 1708.2.1 or 1708.2.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1708.2.1 Load test procedure specified. Where a referenced material standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1708.2.2 shall apply.

1708.2.2 Load test procedure not specified. In the absence of applicable load test procedures contained within a material standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to an approved test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic force-resisting system, at a minimum the test load shall

be equal to the specified factored design loads. For materials such as wood that have strengths that are dependent on load duration, the test load shall be adjusted to account for the difference in load duration of the test compared to the expected duration of the design loads being considered. For statically loaded components, the test load shall be left in place for a period of 24 hours. For components that carry dynamic loads (for example, machine supports or fall arrest anchors), the load shall be left in place for a period consistent with the component's actual function. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

SECTION 1709—PRECONSTRUCTION LOAD TESTS

1709.1 General. Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1709. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

1709.2 Load test procedures specified. Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1709.3 shall apply.

1709.3 Load test procedures not specified. Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1709.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

1709.3.1 Test procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1709.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1709.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the least of:

1. The load at the deflection limitation given in Section 1709.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1709.3.2 Deflection. The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3.

1709.4 Wall and partition assemblies. Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

1709.5 Exterior window and door assemblies. The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709.5.1 or 1709.5.2. For exterior windows and doors tested in accordance with Section 1709.5.1 or 1709.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

Exception: Structural wind load design pressures for window or door assemblies other than the size tested in accordance with Section 1709.5.1 or 1709.5.2 shall be permitted to be different than the design value of the tested assembly, provided that such pressures are determined by accepted engineering analysis or validated by an additional test of the window or door assembly to the alternative allowable design pressure in accordance with Section 1709.5.2. Components of the alternate size assembly shall be the same as the tested or labeled assembly. Where engineering analysis is used, it shall be performed in accordance with the analysis procedures of AAMA 2502 or WDMA I.S. 11.

1709.5.1 Exterior windows and doors. Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1709.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403.2 and 2403.3.

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1709.5.2 Exterior windows and door assemblies not provided for in Section 1709.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM E330. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

1709.5.2.1 Garage doors and rolling doors. Garage doors and rolling doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the pass/fail criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be labeled with a permanent label identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

1709.5.3 Windborne debris protection. Protection of exterior glazed openings in buildings located in windborne debris regions shall be in accordance with Section 1609.2.

1709.5.3.1 Impact protective systems testing and labeling. Impact protective systems shall be tested for impact resistance by an approved independent laboratory for compliance with ASTM E1886 and ASTM E1996 and for design wind pressure for compliance with ASTM E330. Required design wind pressures shall be determined in accordance with ASCE 7, and for the purposes of this section, multiplied by 0.6 to convert to allowable stress design.

Impact protective systems shall have a permanent label applied in accordance with Section 1703.5.4, identifying the manufacturer, product designation, performance characteristics, and approved inspection agency.

1709.6 Skylights and sloped glazing. Skylights and sloped glazing shall comply with the requirements of Chapter 24.

1709.7 Test specimens. Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

SECTION 1710—OFF-SITE CONSTRUCTION [OSHPD 1R, 2 & 5]

1710.1 General. *This section applies to off-site construction and shall govern the requirements for planning, design, fabrication, assembly, inspection and regulatory compliance.*

1710.2 Construction. *In addition to other applicable requirements in this code, off-site construction shall be in accordance with ICC 1200, with the texts modified by Sections 1710.2.1 through 1710.2.2.*

1710.2.1 ICC 1200 Section 301.4. *Replace ICC 1200 Section 301.4 by the following:*

301.4 Use of shipping containers repurposed as buildings and building components. *Use of shipping containers repurposed as buildings and building components is not permitted by the California Building Code (CBC) Section 3114.*

1710.2.2 ICC 1200 Section 503.1. *Modify ICC 1200 Section 503.1 by adding the following:*

Quality Assurance/Quality Control (QA/QC) shall satisfy all the requirements for Testing, Inspection, and Observation (TIO) in the California Building Standards Code (CBSC).

1710.3 Regulatory compliance. *In addition to other applicable requirements in this code, off-site construction shall be inspected and regulated in accordance with ICC 1205, with texts modified by Sections 1710.3.1 through 1710.3.2.*

1710.3.1 ICC 1205 Section 302.1. *Modify ICC 1205 Section 302.1 by adding the following:*

Construction documents for plan approval shall satisfy all the requirements in the California Building Standards Code (CBSC).

1710.3.2 ICC 1205 Section 501.1. *Modify ICC 1205 Section 501.1 by adding the following:*

Testing, Inspection, and Observation (TIO) program shall satisfy all the requirements in the California Building Standards Code (CBSC).

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 17A – SPECIAL INSPECTIONS AND TESTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter								X	X	X				X										
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

17A

SPECIAL INSPECTIONS AND TESTS

User notes:

About this chapter: *Chapter 17A provides a variety of procedures and criteria for testing materials and assemblies, labeling materials and assemblies, and special inspection of structural assemblies. Chapter 17A is applicable to structures regulated by the Division of the State Architect-Structural Safety—including public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Sections 1.9.2.1 [DSA-SS] and 1.9.2.2 [DSA-SS/CC])—and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development—including hospitals and correctional treatment centers (applications listed in Sections 1.10.1 [OSHPD 1] and 1.10.4 [OSHPD 4]).*

SECTION 1701*A*—GENERAL

1701*A*.1 Scope. The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

1701A.1.1 Application. *The scope of application of Chapter 17A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety, which include those applications listed in Sections 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Structures regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1 and 1.10.4. These applications include hospitals and correctional treatment centers.*

1701A.1.2 Amendments in this chapter. *DSA-SS, DSA-SS/CC, OSHPD adopt this chapter and all amendments.*

Exceptions: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect - Structural Safety:*

   [DSA-SS] *For applications listed in Section 1.9.2.1.*

   [DSA-SS/CC] *For applications listed in Section 1.9.2.2.*
2. *Office of Statewide Hospital Planning and Development:*

   [OSHPD 1] *– For applications listed in Section 1.10.1.*

   [OSHPD 4] *– For applications listed in Section 1.10.4.*

1701A.1.3 Reference to other chapters.

1701A.1.3.1 [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A, 22A and 23, the provisions in Chapters 16, 19, 21, 22 and 23, respectively, shall apply instead as defined in Section 1.9.2.2. Referenced sections may not directly correlate, but the corresponding DSA-SS/CC sections to such references still apply.*

1701A.3 Special inspections and tests. [OSHPD 1 & 4] *In addition to the inspector(s) of record required by the California Administrative Code (CCR, Title 24, Part 1), Section 7-144, the owner shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work listed under Chapters 14, 15, 17A, 18A, 19A, 20, 21A, 22A, 23, 24 and 25, and noted in the Test, Inspection and Observation (TIO) program required by Sections 7-141, 7-145 and 7-149, of the California Administrative Code. Test, Inspection and Observation (TIO) program shall satisfy requirements of Section 1704A.*

1701A.4 Special inspections and tests. [DSA-SS & DSA-SS/CC] *In addition to the project inspector required by the California Administrative Code (CCR, Title 24, Part 1), Section 4-333, the owner shall employ one or more approved agencies to provide special inspections and tests as required by the enforcement agency during construction on the types of work listed under Chapters 14, 15, 17A, 18A, 19A, 20, 21A, 22A, 23, 24 and 25 and the California Existing Building Code and noted in the special inspection, test and observation plan required by the California Administrative Code.*

SECTION 1702*A*—NEW MATERIALS

1702*A*.1 General. New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

SECTION 1703*A*—APPROVALS

1703*A*.1 Approved agency. An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements specified in Sections 1703*A*.1.1 through 1703*A*.1.3.

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➡ **1703*A*.1.1 Independence.** An approved agency shall be objective, competent and independent from *any other entity providing inspection services and* contractor*(s)* responsible for the work being inspected. The agency shall disclose to the building official and the registered design professional in responsible charge possible conflicts of interest so that objectivity can be confirmed.

1703*A*.1.2 Equipment. An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

1703*A*.1.3 Personnel. An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and special inspections.

1703*A*.2 Written approval. Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

1703*A*.3 Record of approval. For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be available for public review at appropriate times.

1703*A*.4 Performance. Specific information consisting of test reports conducted by an approved agency in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the product, material or assembly meets the applicable code requirements.

[OSHPD 1 & 4] *Tests performed by an independent approved testing agency/laboratory or under the responsible charge of a competent approved independent Registered Design Professional shall be deemed to comply with requirements of this section. Test reports for structural tests shall be reviewed and accepted by an independent California licensed structural engineer.*

1703*A*.4.1 Research and investigation. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the product, material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the owner or the owner's authorized agent.

1703*A*.4.2 Research reports. Supporting data, where necessary to assist in the approval of products, materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

1703*A*.5 Labeling. Products, materials or assemblies required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703*A*.5.1 through 1703*A*.5.4.

1703*A*.5.1 Testing. An approved agency shall test a representative sample of the product, material or assembly being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

1703*A*.5.2 Inspection and identification. The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product, material or assembly is representative of the product, material or assembly tested.

1703*A*.5.3 Label information. The label shall contain the manufacturer's identification, model number, serial number or definitive information describing the performance characteristics of the product, material or assembly and the approved agency's identification.

1703*A*.5.4 Method of labeling. Information required to be permanently identified on the product, material or assembly shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

1703*A*.6 Evaluation and follow-up inspection services. Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the owner or the owner's authorized agent shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

1703*A*.6.1 Follow-up inspection. The owner or the owner's authorized agent shall provide for special inspections of fabricated items in accordance with Section 1704*A*.2.5.

1703*A*.6.2 Test and inspection records. Copies of necessary test and special inspection records shall be filed with the building official.

SECTION 1704*A*—SPECIAL INSPECTIONS AND TESTS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATION

1704*A*.1 General. Special inspections and tests, statements of special inspections, responsibilities of contractors, submittals to the building official and structural observations shall meet the applicable requirements of this section.

1704*A*.2 Special inspections and tests. Where application is made to the building official for construction as specified in Section 105 ➡ the owner shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705*A* and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building official that are identified in Section 110.

[OSHPD 1 & 4] *The inspectors shall act under the direction of the architect or structural engineer or both, and be responsible to the Owner. Where the California Administrative Code (CAC) Section 7-115 (a) 2 permits construction documents to be prepared under the*

responsible charge of a mechanical, electrical or civil engineer, inspectors shall be permitted to work under the direction of engineer in appropriate branch as permitted therein.

Exceptions:

1. Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
2. ***[DSA-SS, DSA-SS/CC]*** *Reference to Section 105 and Section 110 shall be to the California Administrative Code instead.*

1704*A*.2.1 Special inspector qualifications. Prior to the start of the construction, the approved agencies shall provide written documentation to the building official demonstrating the competence and relevant experience or training of the special inspectors who will perform the special inspections and tests during construction. Experience or training shall be considered to be relevant where the documented experience or training is related in complexity to the same type of special inspection or testing activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as an approved agency and their personnel are permitted to act as special inspectors for the work designed by them, provided they qualify as special inspectors.

1704*A*.2.2 Access for special inspection. The construction or work for which special inspection or testing is required shall remain accessible and exposed for special inspection or testing purposes until completion of the required special inspections or tests.

1704*A*.2.3 Statement of special inspections. The applicant shall submit a statement of special inspections *prepared by the registered design professional in general responsible charge* in accordance with Section 107.1 as a condition for *construction documents review*. This statement shall be in accordance with Section 1704*A*.3.

[DSA-SS, DSA-SS/CC] *Reference to Section 107.1 shall be to the California Administrative Code instead.*

1704*A*.2.4 Report requirement. *The inspector(s) of record and* approved agencies shall keep records of special inspections and tests. The *inspector of record and* approved agency shall submit reports of special inspections and tests to the building official and to the registered design professional in responsible charge at frequencies required by the approved construction documents or building official *as required by the California Administrative Code*. All reports shall describe the nature and extent of inspections and tests, the location where the inspections and tests were performed, and indicate that work inspected or tested was or was not completed in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the building official.

1704*A*.2.5 Special inspection of fabricated items. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspections of the fabricated items shall be performed during fabrication.

1704*A*.2.5.1 Fabricator approval. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1704*A*.3 Statement of special inspections. Where special inspections or tests are required by Section 1705*A*, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704*A*.3.1 for submittal by the applicant in accordance with Section 1704*A*.2.3.

Exception: The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

[DSA-SS, DSA-SS/CC] *The exception is not permitted by DSA.*

1704*A*.3.1 Content of statement of special inspections. The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have special inspections or tests by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspections or tests for seismic or wind resistance as specified in Sections 1705*A*.12, 1705*A*.13 and 1705*A*.14.
5. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the referenced standard where the inspections are defined.
6. Deferred submittal items that require a supplemental statement of special inspections.

1704*A*.3.2 Seismic requirements in the statement of special inspections. Where Section 1705*A*.13 or 1705*A*.14 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the *equipment/components that require special seismic certification* and seismic force-resisting systems that are subject to the special inspections or tests.

1704*A*.3.3 Wind requirements in the statement of special inspections. Where Section 1705*A*.12 specifies special inspection for wind resistance, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components that are subject to special inspections.

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1704*A*.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic force-resisting system, *installation of equipment/components requiring special seismic certification* or a wind- or seismic force-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner or the owner's authorized agent prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspections. ***[DSA-SS, DSA-SS/CC]*** *The contractor's statement is required only when specified on the approved construction documents.*

1704*A*.5 Submittals to the building official. In addition to the submittal of reports of special inspections and tests in accordance with Section 1704*A*.2.4, reports and certificates shall be submitted by the owner or the owner's authorized agent to the building official for each of the following:

1. *Reserved.*
2. *Reserved.*
3. Certificates of compliance for *equipment/components requiring special seismic certification* in accordance with Section 1705*A*.14.3.
4. Reports of preconstruction tests for shotcrete in accordance with ACI 318 *and Section 1705A.3.9.2.*
5. Certificates of compliance for open web steel joists and joist girders in accordance with Section 2207*A*.5.
6. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded.
7. Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category D, E or F.

1704*A*.6 Structural observations. *The* owner shall employ a registered design professional to perform structural observations. The structural observer shall visually observe representative locations of structural systems, details and load paths for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for the inspections in Section 110 or the special inspections in Section 1705*A* or other sections of this code. Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations. At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

[DSA-SS, DSA-SS/CC] *Reference to Section 110 shall be to the California Administrative Code instead.*

SECTION 1705*A*—REQUIRED SPECIAL INSPECTIONS AND TESTS

1705*A*.1 General. Special inspections and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705*A*.1.1 Special cases. Special inspections and tests shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

1705*A*.2 Steel construction. The special inspections and nondestructive testing of steel construction in buildings, structures and portions thereof shall be in accordance with this section.

Exception: Special inspections of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements where required by the approved construction documents.

1705*A*.2.1 Structural steel. Special inspections and nondestructive testing of structural steel elements in buildings, structures and portions thereof shall be in accordance with the quality assurance requirements of AISC 360 *and this code.*

Exception: Special inspection of railing systems composed of structural steel elements shall be limited to welding inspection of welds at the base of cantilevered rail posts.

The following provisions of AISC 360, Chapter N are not permitted:

1. *N5, Item 3 (Coordinated Inspection).*
2. *N6 (Approved Fabricators and Erectors).*
3. ***[DSA-SS, DSA-SS/CC]*** *Quality assurance application of:*
   a. *N5, Item 2 (Quality Assurance).*
   b. *N5, Item 4 (Inspection of Welding).*
   c. *N7 (Nonconforming Material and Workmanship).*

[DSA-SS, DSA-SS/CC] *Additionally, the requirements of Table 1705A.2.1 of the California Building Code shall apply.*

[DSA-SS, DSA-SS/CC] *References to specified standards in Table 1705A.2.1 apply only to those structural systems and elements required to comply with those by this code.*

[DSA-SS, DSA-SS/CC] *Replace AISC 360, Section N5.5(b), as follows:*

For structures in *R*isk *C*ategory *II*, III or IV, as defined in *the California Building Code*, UT shall be performed by QA on all complete-joint-penetration (CJP) groove welds subject to transversely applied tension loading in butt, T- and corner joints, in material $^{5}/_{16}$ in. (8 mm) thick or greater.

[DSA-SS, DSA-SS/CC] TABLE 1705A.2.1-REQUIRED SPECIAL INSPECTIONS AND TESTS OF STEEL CONSTRUCTION

TYPE	***CONTINUOUS SPECIAL INSPECTION***	***PERIODIC SPECIAL INSPECTION***	***REFERENCED STANDARD***	***CBC REFERENCE[a]***
1. Material identification and testing of high-strength bolts, nuts and washers:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—	*X*	*RCSC: 1.5; AISC 360: A3.3, J3.2; AISC 370: A3.3, J3.1; Applicable ASTM material standards*	*2201A.2,* ***[DSA-SS/CC]*** *2201.2*
b. Manufacturer's certificate of compliance required.	—	*X*	*RCSC: 1.5; AISC 360: A3.3, N3.2; AISC 370: A3.3, N3.2*	—
c. Testing of high-strength bolts, nuts and washers.	—	—	*RCSC: 7.2; Applicable ASTM material standards*	*1705A.2.8,* ***[OSHPD 1 & 4]*** *2213A.1*
2. Inspection of high-strength bolting:				
a. Snug-tight joints.	—	*X*	*RCSC: 7-9; AISC 360: J3.2, M2.5, N5.6; AISC 370: J3.1, M2.7, N5.6*	*1705A.2.8, 1705A.13.1, 2201A.4,* ***[DSA-SS/CC]*** *2201.4*
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	—	*X*		
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	*X*	—		
3. Material identification and testing of structural steel and cold-formed steel:				
a. For structural steel and stainless steel, identification markings to conform to AISC 360 and AISC 370, respectively.	—	*X*	*AISC 360: A3, N2.1; AISC 341: A3; AISC 370: A3, N2.1*	*2201A.2,* ***[DSA-SS/CC]*** *2201.2*
b. For cold-formed steel and other steel, identification markings to conform to ASTM standards specified in the approved construction documents.	—	*X*	*AISI S100: A3.1, A3.2; AISI S240: A5.5, D6.6; Applicable ASTM material standards*	*2201A.2,* ***[DSA-SS/CC]*** *2201.2*
c. Manufacturer's certified test reports.	—	*X*	*AISC 360: A3.1, N3.2; AISC 341: A3; AISC 370: A3.1, N3.2*	—
d. Testing of unidentified steel.	—	—	*Applicable ASTM material standards*	*2201A.2,* ***[DSA-SS/CC]*** *2201.2*
4. Material identification of welding consumables and testing of welded elements:				
a. Identification markings to conform to AWS specification in the approved construction documents.	—	*X*	*AISC 360: A3.5, N3.2; AISC 341: A3.4, J3; AISC 370: A3.6, N3.2; Applicable AWS A5 documents*	—
b. Manufacturer's certificate of compliance required.	—	*X*	*AISC 360: N3.2; AISC 341: J3; AISC 370: N3.2*	—
c. Nondestructive testing of welded joints.	—	—	*AISC 360: N5.5; AISC 341: J7; AISC 370: N5.5*	*1705A.2.1, 1705A.14.1*

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[DSA-SS, DSA-SS/CC] TABLE 1705A.2.1-REQUIRED SPECIAL INSPECTIONS AND TESTS OF STEEL CONSTRUCTION—continued				
TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD	CBC REFERENCE[a]
5. Inspection of welding:				
a. Structural steel and cold-formed steel:				
1. Complete and partial joint penetration groove welds.	X	—	AISC 360: J2, M2.4, M4.5; AISC 341: I2.3, J7; AISC 370: J2, M2.6, M3.5; AWS D1.1, AWS D1.6, AWS D1.8	1705A.2.1, 1705A.2.7, 1705A.13.1
2. Multipass fillet welds.	X	—		
3. Single-pass fillet welds > $^5/_{16}$".	X	—		
4. Plug and slot welds.	X	—		
5. Single-pass fillet welds ≤ $^5/_{16}$".	—	X		
6. Floor and roof deck welds.	—	X	AWS D1.3; SDI QA/QC	1705A.2.1, 1705A.2.3, 1705A.2.7, 1705A.13.1
7. End-welded studs.	—	X	AWS D1.1, AWS D1.6	1705A.2.7, 1705A.13.1, 2213A.2, **[DSA-SS/CC]** 2212.6.2
8. Welded sheet steel for cold-formed framing members.	—	X	AWS D1.3; AISI S240: Ch. D	1705A.2.7, 1705A.2.5.1, 1705A.12.2, 1705A.13.3
b. Reinforcing steel.				Table 1705A.3, Item 2
6. Inspection of steel frame joint details for compliance:				
a. Details such as bracing and stiffening.	—	X	AISC 360: M4, N5.8; AISC 341: I2, J9; AISC 358: 3.3–3.6; AISC 370: M3, N5.7	1705A.2.1, 1705A.13.1
b. Member locations.	—	X		
c. Application of joint details at each connection.	—	X		

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1705A.13, Special inspections for seismic resistance.

Notes: [OSHPD 1 & 4]

1. *Quality assurance requirements in AISC 360, AISC 341, AISC 358, AISI S240, SDI QA/QC and AISC 370 are equivalent to special inspection and testing requirements in this code and are provided by approved agencies employed by the Owner.*
2. *Chapter 22A requires the steel fabrication and erection, including quality control, to be in accordance with the AISC 360, AISC 341, AISC 358, AISC 358, AISI S240 and AISC 370.*

1705*A*.2.2 Structural stainless steel. Special inspections and nondestructive testing of structural stainless steel elements in buildings and portions thereof shall be in accordance with the quality assurance requirements of AISC 370 *and this code*.

The following provisions of AISC 370, Chapter N are not permitted:

1. *N5, Item 3 (Coordinated Inspection).*
2. *N6 (Approved Fabricators and Erectors).*
3. ***[DSA-SS, DSA-SS/CC]** Quality assurance application of:*
   a. *N4, Item 3(c) and 3(d) (NDT Personnel Qualifications).*
   b. *N5, Item 2 (Quality Assurance).*
   c. *N5, Item 4 (Inspection of Welding)*
   d. *N7 (Nonconforming Material and Workmanship).*

*[**DSA-SS, DSA-SS/CC**] Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.*

Replace AISC 370, Section N5.5(b), as follows:

For structures in *R*isk *C*ategory *II*, III or IV, as defined in *the California Building Code*, UT shall be performed by QA on all complete-joint-penetration (CJP) groove welds subject to transversely applied tension loading in butt, T- and corner joints, in material $^5/_{16}$ in. (8 mm) thick or greater.

1705*A*.2.3 Cold-formed steel deck. Special inspections for cold-formed steel floor and roof deck shall be in accordance with the quality assurance requirements of SDI QA/QC *and this code.*

***[OSHPD 1 & 4]** SDI QA/QC Section D3 (Coordinated Inspection) is not permitted.*

***[DSA-SS, DSA-SS/CC]** The following provisions of SDI QA/QC are not permitted:*

1. *Section D2 (Quality Assurance).*
2. *Section D3 (Coordinated Inspection).*
3. *Quality assurance application of:*
   a. *Section E (Nonconforming Material and Workmanship).*
   b. *Appendix 1 (Tables of inspection or Execution Tasks).*

Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.

1705*A*.2.4 Open-web steel joists and joist girders. Special inspections of open-web steel joists and joist girders in buildings, structures and portions thereof shall be in accordance with Table 1705*A*.2.4.

TABLE 1705*A*.2.4—REQUIRED SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS

TYPE	*CONTINUOUS SPECIAL INSPECTION*	*PERIODIC SPECIAL INSPECTION*	REFERENCED STANDARD[a]
1. Installation of open-web steel joists and joist girders.			
a. End connections – welding or bolted.	—	X	SJI specifications listed in Section 2207*A*.1.
b. Bridging – horizontal or diagonal.	—	—	—
1. Standard bridging.	—	X	SJI specifications listed in Section 2207*A*.1.
2. Bridging that differs from the SJI specifications listed in Section 2207*A*.1.	—	X	—

a. Where applicable, see Section 1705*A*.13.

1705A.2.4.1 Steel joist and joist girder inspection. *Special inspection is required during the manufacture and welding of steel joists or joist girders. The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected joist or joist girder. This mark or tag shall remain on the joist or joist girder throughout the job site receiving and erection process.*

1705*A*.2.5 Cold-formed steel trusses spanning 60 feet or greater. Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705A.2.5.1 Light-framed steel truss inspection and testing. *Regardless of truss span, the manufacture of cold-formed light-framed steel trusses shall be continuously inspected by an approved agency. The approved agency shall verify conformance of materials and manufacture with approved construction documents. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected truss. This mark or tag shall remain on the truss throughout the job site receiving and erection process. Refer to Section 2206A.1.3.3 for requirements applicable to manufactured trusses specified therein.*

1705*A*.2.6 Metal building systems. Special inspections of metal building systems shall be performed in accordance with Sections 1705*A*.2.1, 1705*A*.2.3, 1705*A*.2.4 and 1705*A*.2.5 and Table 1705*A*.2.6. The approved agency shall perform inspections of the erected metal building system to verify compliance with the approved construction documents.

TABLE 1705*A*.2.6—SPECIAL INSPECTIONS OF METAL BUILDING SYSTEMS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Installation of rafter/beam flange braces and column flange braces.	—	X
2. Installation of purlins and girts, including specified lapping.	—	X
3. Purlin and girt restraint/bridging/bracing.	—	X
4. Installation of X-bracing, tightened to remove any sag.	—	X

1705A.2.7 Special inspections and tests of structural welding. *Special inspection and testing (including nondestructive testing) of all shop and field welding operations shall be in accordance with this section, and Sections 1705A.2.1, 1705A.2.2, 1705A.13.1 and 1705A.14.1, as applicable. Special inspections shall be performed by an approved welding inspector. The minimum requirements for a qualified welding inspector shall be as those for an AWS Certified Welding Inspector (CWI), as defined in the provisions of the AWS QC1 or AWS B5.1.*

The welding inspector shall make a systematic daily record of all welds. This record shall include:

1. *Identification marks of welders.*
2. *List of defective welds.*
3. *Manner of correction of defects.*

*The welding inspector shall check the material, details of construction and procedure, as well as workmanship of the welds. The special inspector shall verify that the installation and testing of end-welded stud shear connectors is in accordance with the requirements of Section 2216A.2 (**[DSA-SS/CC]** 2215.6.2) and the approved construction documents. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding has been done in conformance with AWS D1.1, D1.3, D1.4, D1.6 and D1.8, as applicable and the approved construction documents.*

[DSA-SS, DSA-SS/CC] *Welding inspector approval by the enforcement agency shall occur when specified in the California Administrative Code. Nondestructive testing shall be performed by qualified NDT Level II personnel employed by the approved agency. Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.*

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1705A.2.8 Special inspection and tests of high-strength fastener assemblies. *Special inspections and tests for high-strength fasteners shall be in accordance with this section and Section 1705A.2.1. High-strength bolts, nuts and washers shall be sampled and tested by an approved agency for conformance with the requirements of applicable ASTM standards* ***[OSHPD 1 & 4]*** *and in accordance with Section 2216A.1.*

[DSA-SS, DSA-SS/CC] *The minimum requirements for a qualified high-strength bolting special inspector shall be an International Code Council certified Structural Steel and Bolting Special Inspector (S1). Additionally, the requirements in Table 1705A.2.1 of the California Building Code shall apply.*

1705A.2.9 Special inspection and tests of cold-formed steel light-frame construction. [DSA-SS, DSA-SS/CC] *Special inspections and tests for cold-formed steel light-frame construction shall be in accordance with quality assurance requirements of AISI S240 and this code. Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.*

Quality assurance application is not permitted for the following AISI S240, Chapter D Sections:

1. *D6.4 (Quality Assurance Inspection Tasks).*
2. *D6.5 (Coordinated Inspection).*
3. *D6.7 (Inspection of Welding).*
4. *D6.8 (Inspection of Mechanical Fastening).*
5. *D6.9 (Inspection of Cold-Formed Steel Light-Frame Construction).*
6. *D6.10 (Additional Requirements for Lateral Force-Resisting Systems).*
7. *D7 (Nonconforming Material and Workmanship).*

Basic frame inspection provisions of AISI S240, Chapter D are not permitted and inspector of record inspections shall be in accordance with the California Administrative Code.

1705*A*.3 Concrete construction. Special inspections and tests of concrete construction shall be performed in accordance with this section and Table 1705*A*.3.

➡ **Exception:** Special inspections and tests shall not be required for concrete patios, driveways and sidewalks, on grade.

TABLE 1705*A*.3—REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

	TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	*CBC* REFERENCE
1.	Inspect *and test* reinforcement, including prestressing tendons, and verify placement:			ACI 318: Ch. 20, *26.13.1, 26.13.3.1*	*1705A.3.9, 1908A.1, 1910A.2, 1910A.3;* ***[DSA-SS/CC]*** *1909.2.3, 1909.2.4, 1909.4*
	a. Reinforcement in special moment frames, boundary elements of special structural walls and coupling beams.	X	—	ACI 318: 25.2, 25.3, *25.5.1,* 26.6.1 – 26.6.3*, 26.13.3.2*	
	b. All other reinforcement.	—	X	ACI 318: 25.2, 25.3, *25.5.1*, 26.6.1 – 26.6.3, *26.13.3.3*	
2.	Reinforcing bar welding:			*ACI 318: 26.13.3*	*1705A.3.1, 1903A.8*
	a. Verify weldability of reinforcing bars other than ASTM A706.	—	X	AWS D1.4 ACI 318: 26.13.1.4	
	b. Inspect welding of reinforcement for *intermediate and* special moment frames, boundary elements of special structural walls, coupling beams *and shear reinforcement,* ***[DSA-SS, DSA-SS/CC]*** *and reinforcement for collectors and chords.*	X	—	AWS D1.4 ACI 318: *18.2.8, 25.5.7,* 26.13.3	
	c. Inspect welded reinforcement splices.	X	—	—	
	d. Inspect welding of primary tension reinforcement in corbels.	X	—	—	
	e. Inspect single-pass fillet welds, maximum $^{5}/_{16}$", *not defined in 2.b.*	—	X	AWS D1.4 ACI 318: 26.13.3	
	f. Inspect all other welds.	—	X	AWS D1.4 ACI 318: 26.13.3	
3.	Inspect anchors cast in concrete.	—	X	ACI 318: *26.7.2, 26.8.2, 26.13.1.* 26.13.3.3	—
4.	Inspect *and test* anchors post-installed in hardened concrete members:[b, c]				*1705A.3.8, 1910A.5,* ***[DSA-SS/CC]*** *1909.2.6*
	a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.[c]	X	—	ACI 318: *26.7.2, 26.13.1,* 26.13.3.2	
	b. Mechanical anchors and adhesive anchors not defined in 4.a.	—	X	ACI 318: *26.7.2, 26.13.1,* 26.13.3	

TABLE 1705*A*.3—REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION—continued

	TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	*CBC* REFERENCE
5.	Verify use of required design mix.	—	X	ACI 318: Ch. 19, *26.4*	*1903A.4,* 1904*A*.1, 1904*A*.2, *1910A.1, **[DSA-SS/CC]** 1909.2.1, 1909.2.2*
6.	Prior to *and during* concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C31 ASTM C172 ACI 318: *26.4,* 26.5, 26.12, *26.13.3.2*	*1705A.3.5, 1705A.3.6, 1705A.3.9, 1909A.1.16, **[DSA-SS/CC]** 1909.3.10*
7.	Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5, *26.13, ACI 506: 3.4*	*1705A.3.9, 1909A.13, 1909A.14, **[DSA-SS/CC]** 1909.3.7, 1909.3.8*
8.	Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5, *26.13.3.3*	—
9.	Inspect prestressed concrete for:				—
	a. Application of prestressing forces.	X	—	ACI 318: *26.10.2, 26.13.1, 26.13.3.2*	*1705A.3.4*
	b. Grouting of bonded prestressing tendons.	X	—		
10.	Inspect erection of precast concrete members.	—	X	ACI 318: 26.9, *26.13.1, 26.13.3.3*	—
11.	For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category D, E or F, inspect such connections and reinforcement in the field for:			ACI 318: 26.13.1.3 ACI 550.5	—
	a. Installation of the embedded parts.	X	—		
	b. Completion of the continuity of reinforcement across joints.	X	—		
	c. Completion of connections in the field.	X	—		
12.	Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	—	X	ACI 318: 26.13.1.3	—
13.	Verify in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: *26.10.2,* 26.11.2, *26.13.3.3*	—
14.	Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b), *26.13.3.3*	*1909A.1.15, **[DSA-SS/CC]** 1909.3.9*

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705*A*.13.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 26.13 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

c. Installation of all adhesive anchors in horizontal and upwardly inclined positions shall be performed by an ACI/CRSI Certified Adhesive Anchor Installer, except where the factored design tension on the anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents or where the anchors are shear dowels across cold joints in slabs on grade where the slab is not part of the lateral force-resisting system.

1705*A*.3.1 Welding of reinforcing bars. Special inspections of welding and qualifications of special inspectors for reinforcing bars shall be in accordance with *Section 1705A.2.7,* the requirements of AWS D1.4 for special inspection and of AWS D1.4 for special inspector qualification.

1705*A*.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19, 20 *and 26* of ACI 318, *as modified by Chapter 19A,* the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19, 20 *and 26* of ACI 318 *as modified by Chapter 19A. Cementitious materials shall be in accordance with 1910A.1 ([DSA-SS/CC] 1909.2.3). Tests of reinforcing bars shall be in accordance with Section 1910A.2 (**[DSA-SS/CC]** 1909.2.4).*

1705A.3.3 Batch plant inspection. *Except as provided under this section, the quality and quantity of materials used in transit-mixed concrete and in batched aggregates shall be continuously inspected by an approved agency at the location where materials are measured.*

[DSA-SS, DSA-SS/CC] *The minimum requirements for a qualified batch plant inspector shall be possession of either:*

1. *Both of the following:*
   a. *A valid certification from ACI as a Concrete Field or Lab Testing Technician.*

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b. *Approved agency documented training records of batch plant inspection and California Administrative Code requirements.*

2. *A valid California Civil Engineering license.*

1705A.3.3.1 Waiver of continuous batch plant inspection. *Continuous batch plant inspection may be waived by the registered design professional, subject to approval by the enforcement agency under either of the following conditions:*

A. *The concrete plant complies fully with the requirements of ASTM C94, Sections 9 and 10, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the enforcement agency. The certification shall indicate that the plant has automatic batching and recording capabilities.*

B. *For single-story light-framed construction (without basement or retaining walls higher than 6 feet in height measured from bottom of footing to top of wall) and isolated foundations supporting equipment only, where deep foundation elements are not used.*

When continuous batch plant inspection is waived, the following requirements shall apply and shall be described in the construction documents:

1. *An approved agency shall check the first batch at the start of the day to verify materials and proportions conform to the approved mix design.*
2. *A licensed weighmaster shall positively identify quantity of materials and certify each load by a batch ticket.*
3. *Batch tickets, including material quantities and weights, shall accompany the load, shall be transmitted to the inspector of record by the truck driver with load identified thereon. The load shall not be placed without a batch ticket identifying the mix. The inspector of record shall keep a daily record of placements, identifying each truck, its load, time of receipt at the job site and approximate location of deposit in the structure and shall maintain a copy of the daily record as required by the enforcement agency.*

1705A.3.3.2 Batch plant inspection not required. [DSA-SS, DSA-SS/CC] *Batch plant inspection is not required for any of the following conditions, provided they are identified on the approved construction documents and Items 2 and 3 of Section 1705A.3.3.1 are implemented:*

1. *Site flatwork*
2. *Unenclosed site structures, including but not limited to lunch or car shelters, bleachers, solar structures, flag or light poles, or retaining walls.*
3. *Controlled low-strength material backfill.*
4. *Single-story relocatable buildings less than 2,160 square feet.*
5. *Isolated exterior foundations supporting equipment having a component importance factor of $I_p = 1.0$, where deep foundations are not used.*

1705A.3.4 Inspection and testing of prestressed concrete. *Inspections and tests for prestressed concrete work shall be in accordance with this section. Tests for prestressing steel and anchorage shall be per Section 1910A.3 (**[DSA-SS/CC]** 1909.2.5). Inspection shall be in accordance with the following:*

1. *In addition to the general inspection required for concrete work, all plant fabrication of prestressed concrete members or tensioning of post-tensioned members constructed at the site shall be continuously inspected by an inspector specially approved for this purpose by the enforcement agency.*

   Exception: *The special inspector need not be continuously present for the placement of prestressing or post-tensioned cables or tendons.*

   [DSA-SS, DSA-SS/CC] *Special inspector approval by the enforcement agency shall occur when specified in the California Administrative Code.*
2. *The prestressed concrete plant fabrication inspector shall check the materials, equipment, tensioning procedure and construction of the prestressed members and prepare daily written reports. The approved agency shall make a verified report identifying the members by mark and shall include such pertinent data as lot numbers of tendons used, tendon jacking forces, age and strength of concrete at time of tendon release and such other information that may be required.*
3. *The inspector of prestressed members post-tensioned at the site shall check the condition of the prestressing tendons, anchorage assemblies and concrete in the area of the anchorage, the tensioning equipment and the tensioning procedure and prepare daily written reports. The approved agency shall make a verified report of the prestressing operation identifying the members or tendons by mark and including such pertinent data as the initial cable slack, net elongation of tendons, jacking force developed and such other information as may be required.*
4. *The verified reports of construction shall show that of the inspector's own personal knowledge, the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications for plant fabrication inspection. The verified report shall be accompanied by test reports required for materials used. For site post-tensioning inspections the verified report shall be accompanied by copies of calibration charts, certified by an approved testing laboratory, showing the relationship between gage readings and force applied by the jacks used in the prestressing procedure*

1705A.3.5 Concrete pre-placement inspection. *Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the Inspector of Record.*

1705A.3.6 Placing record. *A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the enforcement agency.*

1705A.3.7 Composite construction cores. *Composite construction cores shall be taken and tested in accordance with Section 1910A.4 (**[DSA-SS/CC]** 1909.2.6).*

1705A.3.8 Special Inspections and tests for post-installed anchors in concrete. [OSHPD 1R, 2 & 5, DSA-SS, DSA-SS/CC] *Special inspections and tests for post-installed anchors in concrete shall be in accordance with Table 1705A.3 and Section 1910A.5 (**[DSA-SS/CC]** 1909.2.7).*

1705A.3.9 Shotcrete. *All shotcrete work shall be continuously inspected during placing by an approved agency. The special shotcrete inspector shall check the materials, placing equipment, details of construction and construction procedure. The approved agency shall furnish a verified report that of his or her own personal knowledge the work covered by the report has been performed and materials have been used and installed in every material respect in compliance with the duly approved plans and specifications.*

[DSA-SS, DSA-SS/CC] *Testing requirements per ACI 318 and ACI 506.2 shall also apply.*

1705A.3.9.1 Visual examination for structural soundness of in-place shotcrete. *Completed shotcrete work shall be checked visually for reinforcing bar embedment, voids, rock pockets, sand streaks and similar deficiencies by examining a minimum of three 3-inch (76 mm) cores taken from three areas chosen by the design engineer which represent the worst congestion of reinforcing bars occurring in the project. Extra reinforcing bars may be added to noncongested areas and cores may be taken from these areas. The cores shall be examined by the special inspector and a report submitted to the enforcement agency prior to final approval of the shotcrete.*

Exception: *Shotcrete work fully supported on earth, minor repairs, and when, in the opinion of the enforcement agency, no special hazard exists.*

1705A.3.9.2 Preconstruction tests. *A shotcrete mockup panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The mockup panel shall be representative of the project and simulate job conditions as closely as possible. The mockup panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. Adequate encasement of bars larger than No. 5 shall be demonstrated by the mockup panel. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official. Reports of preconstruction tests shall be submitted to the building official as specified in Section 1704A.5. Approval from the enforcement agency must be obtained prior to performing shotcrete mockup panels.*

1705*A*.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602, *as set forth in Tables 3 and 4, Level 3 requirements and Chapter 21A. Testing shall be performed in accordance with Section 2105A ([DSA-SS/CC] 2115.8). Special inspection and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17A and 19A. Batch plant inspection of grout materials shall be in accordance with Section 1705A.3.3.*

1705*A*.4.1 Glass unit masonry and masonry veneer in Risk Category *II, III or* IV. Special inspections and tests for glass unit masonry or masonry veneer designed in accordance with Section 2110*A* or Chapter 14, respectively, where they are part of a structure classified as Risk Category *II, III or* IV shall be performed in accordance with TMS 602 *Tables 3 and 4,* Level 2.

1705A.4.1.1 TMS 602 Section 1.6 Quality Assurance. *Replace footnote (d) in TMS 602 Table 4 as follows:*

(d) Periodic *special* inspection *is required for all veneer.*

1705*A*.4.2 Vertical masonry foundation elements. Special inspections and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705*A*.4.

1705*A*.5 Wood construction. Special inspections of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704*A*.2.5 *except as modified in this section*. Special inspections of site-built assemblies shall be in accordance with this section.

1705*A*.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306.2 *or 2307.1* shall be installed with special inspections as indicated in Section 1704*A*.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved construction documents. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved construction documents.

1705*A*.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater. Where a truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705*A*.5.3 Mass timber construction. Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705*A*.5.3.

TABLE 1705*A*.5.3—REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION			
	TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	—	X
2.	Inspect erection of mass timber construction.	—	X
3.	Inspection of connections where installation methods are required to meet design loads.		
	3.1. Threaded fasteners.	—	X
	3.1.1. Verify use of proper installation equipment.	—	X
	3.1.2. Verify use of pre-drilled holes where required.	—	X
	3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle and depth.		
	3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	X	—
	3.3. Adhesive anchors not defined in preceding cell.	—	X
	3.4. Bolted connections.	—	X
	3.5. Concealed connections. *(**[DSA-SS, DSA-SS/CC]** See Sec. 110.3.5 for wood-covered connections.)*	—	X

1705A.5.4 Wood structural elements and assemblies. *Special inspection of wood structural elements and assemblies is required, as specified in this section, to ensure conformance with approved construction documents and applicable standards.*

The approved agency shall furnish a verified report to the design professional in general responsible charge of construction observation, the structural engineer and the enforcement agency, in accordance with the California Administrative Code and this chapter. The verified report shall list all inspected members or trusses, and shall indicate whether or not the inspected members or trusses conform with applicable standards and the approved drawings and specifications. Any nonconforming items shall be indicated on the verified report.

1705A.5.5 Structural glued laminated and cross-laminated timber. *Manufacture of all structural glued laminated and cross-laminated timber shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the approved agency with an identification mark.

Exception: *Special Inspection is not required for non-custom prismatic glued laminated members identified on drawings and sourced from stock or general inventory of $5^1/_2$-inch maximum width and 18-inch maximum depth, and with a maximum clear span of 32 feet, manufactured and marked in accordance with ANSI/APA A190.1 Section 14.1 for noncustom members.*

1705A.5.6 Manufactured open web trusses. *The manufacture of open web trusses shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected truss shall be stamped with an identification mark by the approved agency.

1705A.5.7 Timber connectors. *The installation of all split ring and shear plate timber connectors, and timber rivets shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report verifying that the materials, timber connectors and workmanship conform to the approved construction documents.*

1705*A*.6 Soils. Special inspections and tests of existing site soil conditions, fill placement and load-bearing requirements shall be performed in accordance with this section and Table 1705*A*.6. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

Exception: Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557.

[DSA-SS, DSA-SS/CC] *Additional exceptions to soils special inspections and tests are permitted for the following cases when all the following occur: A) no geotechnical report is required; B) the design is permitted to be and is based on Section 1806A.2 and Table 1806A.2; C) cases are identified on the approved construction documents.*

1. *Deep foundations for the following structures:*
   a. *Freestanding sign or scoreboard.*
   b. *Telecommunications towers and poles less than 35 feet 0 inches above lowest adjacent grade.*
   c. *Poles less than 35 feet 0 inches above lowest adjacent grade for lighting, flags, open mesh fences and similar structures.*

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d. Single-story structure with dead load less than 5 psf.

e. Covered walkway structure with an apex height less than 10 feet 0 inches above lowest adjacent grade.

2. Shallow foundations or excavations for:

a. Buildings meeting Exception 1 criteria in Section 1803A.2 supported by native soil (having any excavation depth) or fill soil (not exceeding 12-inch depth in accordance with Section 1804A.6).

b. Soil scarification or recompaction not exceeding 12-inch depth.

c. Native or fill soil supporting exterior nonstructural flatwork, including sidewalks, site concrete ramps, site stairs, parking lots, driveways and similar cases.

d. Unpaved landscaping and playground areas.

e. Utility trench backfill not exceeding 12-inch depth.

TABLE 1705A.6—REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X

1705A.6.1 Soil fill. *All fills used to support the foundations of any building or structure shall be continuously inspected by the geotechnical engineer or his or her qualified representative. It shall be the responsibility of the geotechnical engineer to verify that fills meet the requirements of the approved construction documents and to coordinate all fill inspection and testing during construction involving such fills.*

The duties of the geotechnical engineer or his or her qualified representative shall include, but need not be limited to, the inspection of cleared areas and benches prepared to receive fill; inspection of the removal of all unsuitable soils and other materials; the approval of soils to be used as fill material; the inspection of placement and compaction of fill materials; the testing of the completed fills; and the inspection or review of geotechnical drainage devices, buttress fills or other similar protective measures in accordance with the approved construction documents.

A verified report shall be submitted by the geotechnical engineer as required by the California Administrative Code. The report shall indicate that all tests and inspections required by the approved construction documents were completed and whether the tested materials and/or inspected work meet the requirements of the approved construction documents.

1705A.6.2 Earth-retaining shoring. *Special inspections and tests of earth-retaining shoring shall be in accordance with applicable portions of Section 1812A.*

1705A.6.3 Vibro stone columns. *Special inspections and tests of vibro stone columns for ground improvement shall be in accordance with Section 1813A.5.*

1705*A*.7 Driven deep foundations. Special inspections and tests shall be performed during installation of driven deep foundation elements as specified in *1810A.3.3.1.2 and* Table 1705*A*.7. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

TABLE 1705*A*.7—REQUIRED SPECIAL INSPECTIONS AND TESTS OF DRIVEN DEEP FOUNDATION ELEMENTS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Inspect driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional special inspections in accordance with Section 1705*A*.2.	In accordance with Section 1705*A*.2	
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705*A*.3.	In accordance with Section 1705*A*.3	
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	In accordance with Statement of Special Inspections	

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1705A.7.1 Driven deep foundations observation. *The installation of driven deep foundations shall be continuously observed by a qualified representative of the geotechnical engineer responsible for that portion of the project.*

The representative of the geotechnical engineer shall make a report of the deep foundation pile-driving operation giving such pertinent data as the physical characteristics of the deep foundation pile-driving equipment, identifying marks for each deep foundation pile, total depth of embedment for each deep foundation; and when the allowable deep foundation pile loads are determined by a dynamic load formula, the design formula used, and the permanent penetration under the last 10 blows. One copy of the report shall be sent to the enforcement agency.

1705*A*.8 Cast-in-place deep foundations. Special inspections and tests shall be performed during installation of cast-in-place deep foundation elements as specified in *1810A.3.3.1.2 and* Table 1705*A*.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

TABLE 1705A.8—REQUIRED SPECIAL INSPECTIONS AND TESTS OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705*A*.3.	In accordance with Section 1705*A*.3	

1705A.8.1 Micropile tests. *Micropile preproduction and production load tests shall be in accordance with Section 1810A.3.10.4.*

1705*A*.9 Helical pile foundations. Continuous special inspections shall be performed during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

1705A.9.1 Helical pile tests. *Helical pile preproduction and production load tests shall be in accordance with Section 1810A.3.1.5.1.*

1705*A*.10 Structural integrity of deep foundation elements. Whenever there is a reasonable doubt as to the structural integrity of a deep foundation element, an engineering assessment shall be required. The engineering assessment shall include tests for defects performed in accordance with ASTM D4945, ASTM D5882, ASTM D6760 or ASTM D7949, or other approved method.

1705*A*.11 Fabricated items. Special inspections of fabricated items shall be performed in accordance with Section 1704*A*.2.5.

1705*A*.12 Special inspections for wind resistance. Special inspections for wind resistance specified in Sections 1705*A*.12.1 through 1705*A*.12.3, unless exempted by the exceptions to Section 1704*A*.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where basic wind speed, *V,* is 150 mph (67 m/sec) or greater.
2. In wind Exposure Category C or D, where basic wind speed, *V,* is 140 mph (62.6 m/sec) or greater.

1705*A*.12.1 Structural wood. Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

1705*A*.12.2 Cold-formed steel light-frame construction. Periodic special inspection is required for welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs. ***[DSA-SS, DSA-SS/CC]*** *Requirements specified in Section 1705A.2.9 shall also apply.*

1705*A*.12.3 Wind-resisting components. Periodic special inspection is required for fastening of the following systems and components:

1. Roof covering, roof deck and roof framing connections.
2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.

1705*A*.13 Special inspections for seismic resistance. Special inspections for seismic resistance shall be required as specified in Sections 1705*A*.13.1 through 1705*A*.13.9, unless exempted by the exceptions of Section 1704*A*.2.

1705*A*.13.1 Structural steel. Special inspections for seismic resistance shall be in accordance with Section 1705*A*.13.1.1 or 1705*A*.13.1.2, as applicable.

1705*A*.13.1.1 Seismic force-resisting systems. Special inspections of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341 *and this code.*

[DSA-SS, DSA-SS/CC] *Quality assurance application is not permitted for the following AISC 341, Chapter J Sections:*

1. *J6 (Inspection Tasks).*

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2. *J7 (Welding Inspection and Nondestructive Testing).*
3. *J10 (Inspection of Composite Structures).*
4. *J11 (Inspection of H-Piles).*

Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.

1705*A*.13.1.2 Structural steel elements. Special inspections of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category D, E or F other than those covered in Section 1705*A*.13.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341 *and this code*.

[DSA-SS, DSA-SS/CC] *Quality assurance application is not permitted for the following AISC 341, Chapter J Sections:*

1. *J6 (Inspection Tasks).*
2. *J7 (Welding Inspection and Nondestructive Testing).*
3. *J10 (Inspection of Composite Structures).*
4. *J11 (Inspection of H-Piles).*

Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.

1705*A*.13.2 Structural wood. For the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F:

1. Continuous special inspection shall be required during field gluing operations of elements of the seismic force-resisting system.
2. Periodic special inspection shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

1705*A*.13.3 Cold-formed steel light-frame construction. For the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F, periodic special inspection shall be required for both:

1. Welding operations of elements of the seismic force-resisting system.
2. Screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

[DSA-SS, DSA-SS/CC] *Requirements specified in Section 1705A.2.9 shall also apply.*

1705*A*.13.4 *Special inspection for special seismic certification*. For structures assigned to Seismic Design Category D, E or F, the special inspector shall examine *equipment and components* requiring *special* seismic *certification* in accordance with Section *1705A.14.3 or* ASCE 7*, Section 13.2.3* and verify that the label, anchorage and mounting conform to the certificate of compliance.

1705*A*.13.5 Architectural components. Periodic special inspection is required for the erection and fastening of exterior cladding, interior and exterior nonbearing walls, *ceilings* and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

[OSHPD 1] Exception: *Periodic special inspection is not required where continuous inspection of the work is performed in accordance with Section 7-145 of the CAC*.

1705*A*.13.5.1 Access floors. Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

1705A.13.5.2 Structural sealant glazing. *Special inspection shall be in accordance with Section 2410.1.2 Item 9.*

1705*A*.13.6 Plumbing, mechanical and electrical components. Periodic special inspection of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to Seismic Design Category D, E or F.
2. Anchorage of other electrical equipment in structures assigned to Seismic Design Category *D,* E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category D, E or F where the approved construction documents require a nominal clearance of $^{1}/_{4}$ inch (6.4 mm) or less between the equipment support frame and restraint.
6. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic sprinkler systems are installed in structures assigned to Seismic Design Category D, E or F to verify one of the following:
    6.1. Minimum clearances have been provided as required by Section 13.2.4 ASCE/SEI 7.
    6.2. A nominal clearance of not less than 3 inches (76 mm) has been be provided between automatic sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.

Where flexible sprinkler hose fittings are used, special inspection of minimum clearances is not required.

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1705*A*.13.7 Storage racks. Steel storage racks and steel cantilevered storage racks that are 8 feet (2438 mm) in height or greater and assigned to Seismic Design Category D, E or F shall be provided with periodic special inspection as required by Table 1705*A*.13.7.

TABLE 1705*A*.13.7—REQUIRED INSPECTIONS OF STORAGE RACK SYSTEMS

TYPE	CONTINUOUS INSPECTION	PERIODIC INSPECTION	REFERENCED STANDARD	IBC REFERENCE
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	—	X	—	—
2. Fabricated storage rack elements.	—	X	—	Section 1704*A*.2.5
3. Storage rack anchorage installation.	—	X	ANSI/MH16.1 Section 7.3.2	—
4. Completed storage rack system, to indicate compliance with the approved construction documents.	—	X	—	—

1705*A*.13.8 Seismic isolation *and damping* systems. Periodic special inspection shall be provided for seismic isolation *and damping* systems in structures assigned to Seismic Design Category D, E or F during the fabrication and installation of isolator units and energy dissipation devices. *Continuous special inspection is required for prototype and production testing of isolator units and damping devices.*

1705*A*.14 Testing for seismic resistance. Testing for seismic resistance shall be required as specified in Sections 1705*A*.14.1 through 1705*A*.14.4, unless exempted from special inspections by the exception of Section 1704*A*.2.

1705*A*.14.1 Structural steel. Nondestructive testing for seismic resistance shall be in accordance with Section 1705*A*.14.1.1 or 1705*A*.14.1.2, as applicable.

1705*A*.14.1.1 Seismic force-resisting systems. Nondestructive testing of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341 *and this code.*

[DSA-SS, DSA-SS/CC] *Quality assurance application is not permitted for the following AISC 341, Chapter J Section:*

1. *J7 (Welding Inspection and Nondestructive Testing).*

Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.

1705*A*.14.1.2 Structural steel elements. Nondestructive testing of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category D, E or F other than those covered in Section 1705*A*.14.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341 *and this code.*

[DSA-SS, DSA-SS/CC] *Quality assurance application is not permitted for the following AISC 341, Chapter J Section:*

1. *J7 (Welding Inspection and Nondestructive Testing).*

Additionally, the applicable portions in Table 1705A.2.1 of the California Building Code shall apply.

1705*A*.14.2 Nonstructural components. For structures assigned to Seismic Design Category D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by *manufacturer's certification* as specified in Item 2 therein, the registered design professional shall specify on the approved construction documents the requirements for seismic *certification* by analysis *or* testing.

Seismic sway bracing components satisfying requirements of ANSI/FM 1950, ANSI/ASHRAE 171, or using an alternative testing protocol approved by the building official shall be deemed to satisfy the requirements of this section.

[OSHPD 1 & 4] Note: *Deemed to comply provisions provide acceptable options to comply with the code but do not mandate their use. Alternative systems in accordance with Section 104.2.3 and the California Administrative Code Section 7-104 are always acceptable when approved by the building official.*

1705A.14.2.1 Structural sealant glazing testing. *Testing and the manufacturer's certification shall be in accordance with Section 2410.1.2.*

1705*A*.14.3 *Special seismic certification*. For structures assigned to Seismic Design Category D, E or F *equipment and components* that are subject to the requirements of Section 13.2.3 of ASCE 7 for *special seismic* certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis *or* testing as specified therein. Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704*A*.5.

Active or energized equipment and components shall be certified exclusively on the basis of approved shake table testing in accordance with ICC-ES AC 156 or equivalent shake table testing criteria approved by the building official. Minimum of two equipment/components shall be tested for a product line with similar structural configuration. Where a range of products are tested,

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the two equipment/components shall be either the largest and a small unit, or approved alternative representative equipment/components.

Exception: *When a single product (and not a product line with more than one product with variations) is certified and manufacturing process is ISO 9001 certified, one test shall be permitted.*

For a multi-component system, where active or energized components are certified by tests, connecting elements, attachments and supports can be justified by supporting analysis.

1705A.14.3.1 Special seismic certification. [OSHPD 1 & 4] *Special seismic certification shall be required for the following systems, equipment and components:*

1. *Emergency and standby power systems.*
2. *Elevator equipment (excluding elevator cabs).*
3. *Components with hazardous contents.*
4. *Exhaust and smoke control fans.*
5. *Switchgear and switchboards.*
6. *Motor control centers.*
7. *Imaging equipment needed for diagnostic services of emergency/trauma patients, a minimum of one such equipment.*
8. *Air conditioning units excluding Variable/Constant Air Volume (VAV/CAV) boxes up to 75 lbs.*
9. *Air handling units.*
10. *Chillers, including associated evaporators, and condensers.*
11. *Cooling towers.*
12. *Transformers.*
13. *Electrical substations.*
14. *UPS and batteries.*
15. *Panelboards as defined in the California Electrical Code (CEC) Article 100.*
16. *Industrial control panels as defined in the California Electrical Code (CEC) Article 100.*
17. *Power isolation and correction systems.*
18. *Motorized surgical lighting systems.*
19. *Motorized operating table systems.*
20. *Internal communication servers, routers and switches failure of which could impair the continued operation of the facility.*
21. *Medical gas and vacuum systems.*
22. *Electrical busways as defined in UL 857.*
23. *Electrical control panels powered by the life safety branch in accordance with the California Electrical Code (CEC) Article 517.33 or the critical branch in accordance with the California Electrical Code (CEC) Article 517.34.*

Exceptions:

1. *Equipment and components weighing not more than 75 lbs. rigidly attached to structures or surface mounted on equipment or components that are not required to have special seismic certification by this section.*
2. *Mobile equipment/components.*
3. *Pipes, ducts, conduits and cable trays, excluding in-line equipment and components.*
4. *Underground tanks.*
5. *Electric motors, base-mounted horizontal pumps and compressors.*
6. *Based-mounted vertical pumps up to 20 hp.*
7. *Substitution of certified active subcomponents up to operating weight of 10 lbs.*
8. *Components where importance factor, I_p, is permitted to be 1.0 by this code.*
9. *Emergency generators up to 25 kilowatts.*
10. *Equipment and components used for clinical trials only.*
11. *Elevator machines and governors.*
12. *Temporary and Interim equipment.*

For Exceptions 5, 6 and 7:

Exempt subcomponents, which are an integral part of equipment that require special seismic certification, shall be tested attached to the equipment. Exempt subcomponents shall be permitted to be substituted without testing, provided that the substituted subcomponent relative to the certified subcomponent has:

1. *Similar configuration with equivalent function.*
2. *Supports and attachments of similar configuration with equivalent strength and stiffness.*
3. *Same attachment location.*

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4. *Changes in dimensions, center of gravity and mass, of not more than 10 percent of the certified subcomponent and still meets Exception 5, 6 or 7.*
5. *Manufacturing process with ISO 9001 certification.*

1705*A*.14.4 Seismic isolation *and damping* systems. Seismic isolation *and damping* systems in structures assigned to Seismic Design Category D, E or F shall be tested in accordance with Section 17.8 *and 18.6* of ASCE 7.

Prototype and production testing and associated acceptance criteria for isolator units and damping devices shall be subject to preapproval by the building official. Testing exemption for similar units shall require approval by the building official.

[BF] 1705*A*.15 Sprayed fire-resistive materials (SFRM). Special inspections and tests of sprayed fire-resistive materials (SFRM) applied to floor, roof and wall assemblies and structural members shall be performed in accordance with Sections 1705*A*.15.1 through 1705*A*.15.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections and tests shall be performed during construction with an additional visual inspection after the rough installation of electrical, automatic sprinkler systems, mechanical and plumbing systems and suspension systems for ceilings, and before concealment where applicable. The required sample size shall not exceed 110 percent of that specified by the referenced standards in Sections 1705*A*.15.4.1 through 1705*A*.15.4.9.

[BF] 1705*A*.15.1 Physical and visual tests. The special inspections and tests shall include the following to demonstrate compliance with the listing and the fire-resistance rating:

1. Condition of substrates.
2. Thickness of application.
3. Density in pounds per cubic foot (kg/m^3).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

[BF] 1705*A*.15.2 Structural member surface conditions. The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected by the special inspector before the application of the SFRM.

[BF] 1705*A*.15.3 Application. The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.

[BF] 1705*A*.15.4 Thickness. Not more than 10 percent of the thickness measurements of the SFRM applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, and none shall be less than the minimum allowable thickness required by Section 1705*A*.15.4.1.

[BF] 1705*A*.15.4.1 Minimum allowable thickness. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus $^1/_4$ inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E605. Samples of the SFRM shall be selected in accordance with Sections 1705*A*.15.4.2 *through 1705A.15.4.9*.

[BF] 1705*A*.15.4.2 Floor, roof and wall assemblies. The thickness of the SFRM applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E605, making not less than four measurements for each 1,000 square feet (93 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705*A*.15.4.3 Cellular decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area.

[BF] 1705*A*.15.4.4 Fluted decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

[BF] 1705*A*.15.4.5 Structural members. The thickness of the SFRM applied to structural members shall be determined in accordance with ASTM E605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

[BF] 1705*A*.15.4.6 Beams and girders. At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.7 Joists and trusses. At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

[BF] 1705*A*.15.4.8 Wide-flanged columns. At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705*A*.15.4.9 Hollow structural section and pipe columns. At hollow structural section and pipe columns, thickness measurements shall be made at not fewer than four locations around the column at each end of a 12-inch (305 mm) length.

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[BF] 1705*A*.15.5 Density. The density of the SFRM shall be not less than the density specified in the approved fire-resistance design. Density of the SFRM shall be determined in accordance with ASTM E605. The test samples for determining the density of the SFRM shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each story.

[BF] 1705*A*.15.6 Bond strength. The cohesive/adhesive bond strength of the cured SFRM applied to floor, roof and wall assemblies and structural members shall be not less than 150 pounds per square foot (psf) (7.18 kN/m^2). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E736 by testing in-place samples of the SFRM selected in accordance with Sections 1705*A*.15.6.1 through 1705*A*.15.6.3.

[BF] 1705*A*.15.6.1 Floor, roof and wall assemblies. The test samples for determining the cohesive/adhesive bond strength of the SFRM shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705*A*.15.6.2 Structural members. The test samples for determining the cohesive/adhesive bond strength of the SFRM shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each story.

[BF] 1705*A*.15.6.3 Primer, paint and encapsulant bond tests. Bond tests to qualify a primer, paint or encapsulant shall be conducted where the SFRM is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the SFRM has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

[BF] 1705*A*.16 Intumescent fire-resistive materials. Special inspections and tests for intumescent fire-resistive materials applied to structural elements and decks shall be performed in accordance with AWCI 12-B. Special inspections and tests shall be based on the fire-resistance design as designated in the approved construction documents. Special inspections and tests shall be performed during construction. Additional visual inspection shall be performed after the rough installation and, where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

[BF] 1705*A*.17 Exterior insulation and finish systems (EIFS). Special inspections shall be required for all EIFS applications.

Exceptions:

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.
2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

[BF] 1705*A*.17.1 Water-resistive barrier coating. A water-resistive barrier coating complying with ASTM E2570 requires special inspection of the water-resistive barrier coating where installed over a sheathing substrate.

[BF] 1705*A*.18 Fire-resistant penetrations and joints. In high-rise buildings, in buildings assigned to Risk Category III or IV, or in fire areas containing Group R occupancies with an occupant load greater than 250, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire containment systems that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705*A*.18.1 or 1705*A*.18.2.

[DSA SS, DSA-SS/CC] *Buildings assigned to Risk Category II, III or IV shall be subject to special inspections for fire-resistant penetrations and joints.*

[BF] 1705*A*.18.1 Penetration firestops. Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.4.1.2 and 714.5.1.2 shall be conducted by an approved agency in accordance with ASTM E2174.

[BF] 1705*A*.18.2 Fire-resistant joint systems. Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3.1 and 715.4 shall be conducted by an approved agency in accordance with ASTM E2393.

[F] 1705*A*.19 Testing for smoke control. Smoke control systems shall be tested by a special inspector.

[F] 1705*A*.19.1 Testing scope. The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.

[F] 1705*A*.19.2 Qualifications. Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

1705*A*.20 Sealing of mass timber. Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to mass timber building elements as designated in the approved construction documents.

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SECTION 1706*A*—DESIGN STRENGTHS OF MATERIALS

1706*A*.1 Conformance to standards. The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

1706*A*.2 New materials. For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707*A*.

SECTION 1707*A*—ALTERNATIVE TEST PROCEDURE

1707*A*.1 General. In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.2.3. The cost of all tests and other investigations required under the provisions of this code shall be borne by the owner or the owner's authorized agent.

SECTION 1708*A*—IN-SITU LOAD TESTS

1708*A*.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. The in-situ load tests shall be conducted in accordance with Section 1708*A*.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1708*A*.2 In-situ load tests. In-situ load tests shall be conducted in accordance with Section 1708*A*.2.1 or 1708*A*.2.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1708*A*.2.1 Load test procedure specified. Where a referenced material standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1708*A*.2.2 shall apply.

1708*A*.2.2 Load test procedure not specified. In the absence of applicable load test procedures contained within a material standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to an approved test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic force-resisting system, at a minimum the test load shall be equal to the specified factored design loads. For materials such as wood that have strengths that are dependent on load duration, the test load shall be adjusted to account for the difference in load duration of the test compared to the expected duration of the design loads being considered. For statically loaded components, the test load shall be left in place for a period of 24 hours. For components that carry dynamic loads (for example, machine supports or fall arrest anchors), the load shall be left in place for a period consistent with the component's actual function. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604*A*.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

SECTION 1709*A*—PRECONSTRUCTION LOAD TESTS

1709*A*.1 General. Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1709*A*. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

1709*A*.2 Load test procedures specified. Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1709*A*.3 shall apply.

1709*A*.3 Load test procedures not specified. Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1709*A*.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

1709*A*.3.1 Test procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be

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considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1709*A*.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1709*A*.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the least of:

1. The load at the deflection limitation given in Section 1709*A*.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1709*A*.3.2 Deflection. The deflection of structural members under the design load shall not exceed the limitations in Section 1604*A*.3.

1709*A*.4 Wall and partition assemblies. Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

1709*A*.5 Exterior window and door assemblies. The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709*A*.5.1 or 1709*A*.5.2. For exterior windows and doors tested in accordance with Section 1709*A*.5.1 or 1709*A*.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

Exception: Structural wind load design pressures for window or door assemblies other than the size tested in accordance with Section 1709*A*.5.1 or 1709*A*.5.2 shall be permitted to be different than the design value of the tested assembly, provided that such pressures are determined by accepted engineering analysis or validated by an additional test of the window or door assembly to the alternative allowable design pressure in accordance with Section 1709*A*.5.2. Components of the alternate size assembly shall be the same as the tested or labeled assembly. Where engineering analysis is used, it shall be performed in accordance with the analysis procedures of AAMA 2502 or WDMA I.S. 11.

1709*A*.5.1 Exterior windows and doors. Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1709*A*.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403.2 and 2403.3.

1709*A*.5.2 Exterior windows and door assemblies not provided for in Section 1709*A*.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM E330. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

1709*A*.5.2.1 Garage doors and rolling doors. Garage doors and rolling doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the pass/fail criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be labeled with a permanent label identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

1709*A*.5.3 Windborne debris protection. Protection of exterior glazed openings in buildings located in windborne debris regions shall be in accordance with Section 1609*A*.2.

1709*A*.5.3.1 Impact protective systems testing and labeling. Impact protective systems shall be tested for impact resistance by an approved independent laboratory for compliance with ASTM E1886 and ASTM E1996 and for design wind pressure for compliance with ASTM E330. Required design wind pressures shall be determined in accordance with ASCE 7, and for the purposes of this section, multiplied by 0.6 to convert to allowable stress design.

Impact protective systems shall have a permanent label applied in accordance with Section 1703*A*.5.4, identifying the manufacturer, product designation, performance characteristics, and approved inspection agency.

1709*A*.6 Skylights and sloped glazing. Skylights and sloped glazing shall comply with the requirements of Chapter 24.

1709*A*.7 Test specimens. Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

SECTION 1710A—OFF-SITE CONSTRUCTION [OSHPD 1 & 4]

1710A.1 General. *This section applies to off-site construction and shall govern the requirements for planning, design, fabrication, assembly, inspection and regulatory compliance.*

1710A.2 Construction. *In addition to other applicable requirements in this code, off-site construction shall be in accordance with ICC 1200, with the texts modified by Sections 1710A.2.1 through 1710A.2.2.*

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1710A.2.1 ICC 1200 Section 301.4. *Replace ICC 1200 Section 301.4 by the following:*

301.4 Use of shipping containers repurposed as buildings and building components. *Use of shipping containers repurposed as buildings and building components is not permitted by the California Building Code (CBC) Section 3114.*

1710A.2.2 ICC 1200 Section 503.1. *Modify ICC 1200 Section 503.1 by adding the following:*

Quality Assurance/Quality Control (QA/QC) shall satisfy all the requirements for Testing, Inspection, and Observation (TIO) in the California Building Standards Code (CBSC).

1710A.3 Regulatory compliance. *In addition to other applicable requirements in this code, off-site construction shall be inspected and regulated in accordance with ICC 1205, with texts modified by Sections 1710A.3.1 through 1710A.3.2.*

1710A.3.1 ICC 1205 Section 302.1. *Modify ICC 1205 Section 302.1 by adding the following:*

Construction documents for plan approval shall satisfy all the requirements in the California Building Standards Code (CBSC).

1710A.3.2 ICC 1205 Section 501.1. *Modify ICC 1205 Section 501.1 by adding the following:*

Testing, Inspection, and Observation (TIO) program shall satisfy all the requirements in the California Building Standards Code (CBSC).

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 18 – SOILS AND FOUNDATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	**X**												**X**			**X**								
Adopt entire chapter as amended (amended sections listed below)				**X**	**X**						**X**	**X**			**X**									
Adopt only those sections that are listed below																								
Chapter / Section																								
1801.1.1 – 1801.1.3											X	X			X									
1802.1				X																				
1803.1											X	X			X									
1803.1.1 – 1803.1.1.5				X																				
1803.2											X	X			X									
1803.3.1											X	X			X									
1803.6											X	X			X									
1803.7											X	X			X									
1804.4.1				X																				
1805.2											X	X			X									
1805.4.1				X																				
1807.1.3											X	X			X									
1807.1.4											X	X			X									
1807.1.5											X	X			X									
1807.1.6											X	X			X									
1807.2.2											X	X			X									
1808.8											X	X			X									
Table 1808.8.1											X	X			X									
1808.8.6											X	X			X									
1809.3											X	X			X									
1809.7											X	X			X									
1809.8											X	X			X									
1809.9											X	X			X									
1809.12											X	X			X									
1809.15											X	X			X									
1810.3.1.5.1											X	X			X									
1810.3.2.4											X	X			X									
1810.3.3.1.9											X	X			X									
1810.3.5.3.3											X	X			X									
1810.3.8											X	X			X									
1810.3.10.4				X																				
1810.3.10.4.1											X	X			X									
1810.3.11											X	X			X									
1810.3.11.2											X	X			X									
1810.4.1.5											X	X			X									
1811 – 1813											X	X			X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

18 SOILS AND FOUNDATIONS

User notes:

About this chapter: Chapter 18 provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads imposed by the structure above. This chapter includes requirements for soils investigation and site preparation for receiving a foundation, including the load-bearing values for soils and protection for the foundation from frost and water intrusion. Section 1808 addresses the basic requirements for all foundation types while subsequent sections address foundation requirements that are specific to shallow foundations and deep foundations.

ICC code development note: Code change proposals to this chapter will be considered by the IBC–Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 1801—GENERAL

1801.1 Scope. The provisions of this chapter shall apply to building and foundation systems.

***1801.1.1 Application**. **[OSHPD 1R, 2 & 5]** The scope of application of Chapter 18 is as follows:*

Structures regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD), which include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings, as listed in Sections 1.10.1, 1.10.2 and 1.10.5.

***1801.1.2 Amendments in this chapter. [OSHPD 1R, 2 & 5]** OSHPD adopts this chapter as amended.*

***1801.1.3 Identification of amendments. [OSHPD 1R, 2 & 5]** Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:*

***[OSHPD 1R**] – For applications listed in Section 1.10.1.*

***[OSHPD 2]** – For applications listed in Section 1.10.2.*

***[OSHPD 5]** – For applications listed in Section 1.10.5.*

SECTION 1802—DESIGN BASIS

1802.1 General. Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2. The quality and design of materials used structurally in excavations and foundations shall comply with the requirements specified in Chapters 16, 19, 21, 22 and 23. Excavations and fills shall comply with Chapter 33.

***[HCD 1]** For limited-density owner-built rural dwellings, pier foundations, stone masonry footings and foundations, pressure-treated lumber, poles or equivalent foundation materials or designs may be used, provided that the bearing is sufficient for the purpose intended.*

SECTION 1803—GEOTECHNICAL INVESTIGATIONS

1803.1 General. Geotechnical investigations shall be conducted in accordance with Section 1803.2 and reported in accordance with Section 1803.6. Where required by the building official or where geotechnical investigations involve in-situ testing, laboratory testing or engineering calculations, such investigations shall be conducted by a registered design professional. ***[OSHPD 1R, 2 & 5]** The classification, testing and investigation of the soil shall be made under the responsible charge of a California registered geotechnical engineer. All recommendations contained in geotechnical and geohazard reports shall be subject to the approval of the enforcement agency. All reports shall be prepared and signed by a registered geotechnical engineer, certified engineering geologist and a registered geophysicist, where applicable.*

***1803.1.1 General and where required for applications listed in Section 1.8.2.1.1 regulated by the Department of Housing and Community Development. [HCD 1]** Foundation and soils investigations shall be conducted in conformance with Health and Safety Code Sections 17953 through 17957 as summarized below.*

***1803.1.1.1 Preliminary soil report.** Each city, county, or city and county shall enact an ordinance which requires a preliminary soil report, prepared by a civil engineer who is registered by the state. The report shall be based upon adequate test borings or excavations, of every subdivision, where a tentative and final map is required pursuant to Section 66426 of the Government Code.*

The preliminary soil report may be waived if the building department of the city, county, or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, shall determine that, due to the knowledge such department has as to the soil qualities of the soil of the subdivision or lot, no preliminary analysis is necessary.

***1803.1.1.2 Soil investigation by lot, necessity, preparation and recommendations.** If the preliminary soil report indicates the presence of critically expansive soils or other soil problems which, if not corrected, would lead to structural defects, such ordinance shall require a soil investigation of each lot in the subdivision.*

The soil investigation shall be prepared by a civil engineer who is registered in this state. It shall recommend corrective action which is likely to prevent structural damage to each dwelling proposed to be constructed on the expansive soil.

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1803.1.1.3 Approval, building permit conditions, appeal. *The building department of each city, county, or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, shall approve the soil investigation if it determines that the recommended action is likely to prevent structural damage to each dwelling to be constructed. As a condition to the building permit, the ordinance shall require that the approved recommended action be incorporated in the construction of each dwelling. Appeal from such determination shall be to the local appeals board.*

1803.1.1.4 Liability. *A city, county, city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, is not liable for any injury which arises out of any act or omission of the city, county, city and county, other enforcement agency, or a public employee or any other person under Section 1803.1.1.*

1803.1.1.5 Alternate procedures. *The governing body of any city, county, or city and county may enact an ordinance prescribing an alternate procedure which is equal to or more restrictive than the procedure specified in Section 1803.1.1.*

1803.2 Investigations required. Geotechnical investigations shall be conducted in accordance with Sections 1803.3 through 1803.5.

Exception: The building official shall be permitted to waive the requirement for a geotechnical investigation where satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in Sections 1803.5.1 through 1803.5.6 and Sections 1803.5.10 and 1803.5.11.

[OSHPD 1R, 2 & 5] *Geotechnical reports are not required for one-story, wood-frame and light-steel-frame buildings of Type V construction and 4,000 square feet (371 m^2) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS). Allowable foundation and lateral soil pressure values may be determined from Table 1806.2.*

1803.3 Basis of investigation. Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

1803.3.1 Scope of investigation. The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

[OSHPD 1R, 2 & 5] *There shall not be less than one boring or exploration shaft for each 5,000 square feet (465 m^2) of building area at the foundation level with a minimum of two provided for any one building. A boring may be considered to reflect subsurface conditions relevant to more than one building, subject to the approval of the enforcement agency.*

Borings shall be of sufficient size to permit visual examination of the soil in place or, in lieu thereof, cores shall be taken.

Borings shall be of sufficient depth and size to adequately characterize subsurface conditions.

Exception: *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel frame construction.*

1803.4 Qualified representative. The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on site during all boring or sampling operations.

1803.5 Investigated conditions. Geotechnical investigations shall be conducted as indicated in Sections 1803.5.1 through 1803.5.12.

1803.5.1 Classification. Soil materials shall be classified in accordance with ASTM D2487. Rock shall be classified in accordance with ASTM D5878.

1803.5.2 Questionable soil and rock. Where the classification, strength, moisture sensitivity or compressibility of the soil or rock is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that a geotechnical investigation be conducted.

1803.5.3 Expansive soil. In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D4318.
2. More than 10 percent of the soil particles pass a No.200 sieve (75 µm), determined in accordance with ASTM D6913.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D6913.
4. Expansion index greater than 20, determined in accordance with ASTM D4829.

1803.5.4 Groundwater. A geotechnical investigation shall be performed to determine if:

1. Groundwater is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.
2. The groundwater depth will affect the design and construction of buildings and structures.

1803.5.5 Deep foundations. Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data on which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.

2. Recommended center-to-center spacing of deep foundation elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

1803.5.6 Rock strata. Where foundations are to be constructed on or in rock, the geotechnical investigation shall assess variations in rock strata depth, competency and load-bearing capacity.

1803.5.7 Excavation near foundations. Where excavation will reduce support from any foundation, a registered design professional shall prepare an assessment of the structure as determined from examination of the structure, available design documents, available subsurface data, and, if necessary, excavation of test pits. The registered design professional shall determine the requirements for support and protection of any existing foundation and prepare site-specific plans, details and sequence of work for submission. Such support shall be provided by under-pinning, bracing, excavation retention systems or by other means acceptable to the building official.

1803.5.8 Compacted fill material. Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

1803.5.9 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the *CLSM*.
4. Test methods for determining the acceptance of the *CLSM* in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

1803.5.10 Alternate setback and clearance. Where setbacks or clearances other than those required in Section 1808.7 are desired, the building official shall be permitted to require a geotechnical investigation by a registered design professional to demonstrate that the intent of Section 1808.7 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

1803.5.11 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, a geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.
3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

1803.5.12 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, the geotechnical investigation required by Section 1803.5.11 shall include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to design earthquake ground motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude and source characteristics consistent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on one of the following:
    2.1. A site-specific study in accordance with Chapter 21 of ASCE 7.
    2.2. In accordance with Section 11.8.3 of ASCE 7.
3. An assessment of potential consequences of liquefaction and soil strength loss including, but not limited to, the following:

3.1. Estimation of total and differential settlement.
3.2. Lateral soil movement.
3.3. Lateral soil loads on foundations.
3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction.
3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations.
3.6. Increases in soil lateral pressures on retaining walls.
3.7. Flotation of buried structures.

4. Discussion of mitigation measures such as, but not limited to, the following:
4.1. Selection of appropriate foundation type and depths.
4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces.
4.3. Ground stabilization.
4.4. Any combination of these measures and how they shall be considered in the design of the structure.

1803.6 Reporting. Where geotechnical investigations are required, a written report of the investigations shall be submitted to the building official by the permit applicant at the time of permit application. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered.
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.
6. Expected total and differential settlement.
7. Deep foundation information in accordance with Section 1803.5.5.
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803.5.8.
10. Controlled low-strength material properties and testing in accordance with Section 1803.5.9.
11. ***[OSHPD 1R, 2 & 5]*** *The report shall consider the effects of seismic hazard in accordance with Section 1803.7.*

1803.7 Geohazard reports. [OSHPD 1R, 2 & 5] *Geohazard reports shall be required for all proposed construction.*

Exceptions:

1. *Reports are not required for one-story, wood-frame and light-steel-frame buildings of Type V skilled nursing or intermediate care facilities construction and 4,000 square feet (371 m^2) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS);*
2. *Reports are not required for the following scopes of work in existing buildings:*

   Nonstructural alterations, voluntary structural alterations without foundation work, and incidental structural additions or alterations, and structural repairs for other than earthquake damage.
3. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

The purpose of the geohazard report shall be to identify geologic and seismic conditions that may require project mitigations. The reports shall contain data which provide an assessment of the nature of the site and potential for earthquake damage based on appropriate investigations of the regional and site geology, project foundation conditions and the potential seismic shaking at the site. The report shall be prepared by a California-certified engineering geologist in consultation with a California-registered geotechnical engineer.

The preparation of the geohazard report shall consider the most recent CGS Note 48; Checklist for the Review of Engineering Geology and Seismology Reports for California Public School, Hospitals and Essential Services Buildings. In addition, the most recent version of CGS Special Publication 42: Earthquake Fault Zones, A Guide for Government Agencies, Property Owners / Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, shall be considered for project sites proposed within an Alquist-Priolo Earthquake Fault Zone. The most recent version of CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, shall be considered for project sites proposed within a Seismic Hazard Zone. All conclusions shall be fully supported by satisfactory data and analysis.

In addition to requirements in Sections 1803.5.11 and 1803.5.12, the report shall include, but need not be limited to, the following:

1. *Site geology.*
2. *Evaluation of the known active and potentially active faults, both regional and local.*
3. *Ground-motion parameters, as required by Section 1613 and ASCE 7.*

SECTION 1804—EXCAVATION, GRADING AND FILL

1804.1 Excavation near foundations. Excavation for any purpose shall not reduce vertical or lateral support for any foundation or adjacent foundation without first underpinning or protecting the foundation against detrimental lateral or vertical movement, or both, in accordance with Section 1803.5.7.

1804.2 Underpinning. Where underpinning is chosen to provide the protection or support of adjacent structures, the underpinning system shall be designed and installed in accordance with provisions of this chapter and Chapter 33.

1804.2.1 Underpinning sequencing. Underpinning shall be installed in a sequential manner that protects the neighboring structure and the working construction site. The sequence of installation shall be identified in the approved construction documents.

1804.3 Placement of backfill. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a controlled low-strength material (*CLSM*). The backfill shall be placed in lifts and compacted in a manner that does not damage the foundation or the waterproofing or dampproofing material.

Exception: *CLSM* need not be compacted.

1804.4 Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 1 unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped not less than 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped not less than 2 percent away from the building.

Exceptions:

1. Where climatic or soil conditions warrant, the slope of the ground away from the building foundation shall be permitted to be reduced to not less than 1 unit vertical in 48 units horizontal (2-percent slope).
2. Impervious surfaces shall be permitted to be sloped less than 2 percent where the surface is a door landing or ramp that is required to comply with Section 1010.1.4, 1012.3 or 1012.6.1.

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

1804.4.1 [HCD 1] Construction plans. *Construction plans shall indicate how the site grading or drainage system will manage all surface water flows to keep water from entering buildings in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.1.*

1804.5 Grading and fill in flood hazard areas. In flood hazard areas established in Section 1612.3, grading, fill, or both, shall not be approved:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of flood water and, as applicable, wave action.
2. In floodways, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a registered design professional in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in flood levels during the occurrence of the design flood.
3. In coastal high hazard areas, unless such fill is conducted or placed to avoid diversion of water and waves toward any building or structure.
4. Where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated that the cumulative effect of the proposed flood hazard area encroachment, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point.

1804.6 Compacted fill material. Where shallow foundations will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803.

Exception: Compacted fill material 12 inches (305 mm) in depth or less need not comply with an approved report, provided that the in-place dry density is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557. The compaction shall be verified by special inspection in accordance with Section 1705.6.

1804.7 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803.

SECTION 1805—DAMPPROOFING AND WATERPROOFING

1805.1 General. Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and dampproofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1202.4.

1805.1.1 Story above grade plane. Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be dampproofed in accordance with Section 1805.2 and a foundation drain shall be installed in accordance with Section 1805.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1803.5.4, 1805.3 and 1805.4.1 shall not apply in this case.

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1805.1.2 Under-floor space. The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the under-floor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1803.5.4, 1805.2, 1805.3 and 1805.4 shall not apply in this case.

1805.1.2.1 Flood hazard areas. For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on one side or more.

Exception: Under-floor spaces of Group R-3 buildings that meet the requirements of FEMA TB 11.

1805.1.3 Ground-water control. Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with Section 1805.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

1805.2 Dampproofing. Where hydrostatic pressure will not occur as determined by Section 1803.5.4, floors and walls for other than wood foundation systems shall be dampproofed in accordance with this section. ***[OSHPD 1R, 2 & 5]*** *Wood foundation systems are not permitted by OSHPD.* Wood foundation systems shall be constructed in accordance with AWC PWF.

1805.2.1 Floors. Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1805.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.2.2 Walls. Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level.

Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m^2) of acrylic modified cement, $^1/_8$ inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C887, any of the materials permitted for waterproofing by Section 1805.3.2 or other approved methods or materials.

1805.2.2.1 Surface preparation of walls. Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than $^3/_8$ inch (9.5 mm) of Portland cement mortar. The parging shall be coved at the footing.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

1805.3 Waterproofing. Where the ground-water investigation required by Section 1803.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805.1.3, walls and floors shall be waterproofed in accordance with this section.

1805.3.1 Floors. Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.3.2.1 Surface preparation of walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805.2.2.1.

1805.3.3 Joints and penetrations. Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made watertight utilizing approved methods and materials.

1805.4 Subsoil drainage system. Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805.1.3 shall be deemed adequate for lowering the ground-water table.

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1805.4.1 Floor base course. Floors of basements, except as provided for in Section 1805.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

Exceptions*:*

1. Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.
2. ***[HCD 1]*** *When a capillary break is installed in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

1805.4.2 Foundation drain. A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend not less than 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

1805.4.3 Drainage discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *California Plumbing Code*.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

SECTION 1806—PRESUMPTIVE LOAD-BEARING VALUES OF SOILS

1806.1 Load combinations. The presumptive load-bearing values provided in Table 1806.2 shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2. The values of vertical foundation pressure and lateral bearing pressure given in Table 1806.2 shall be permitted to be increased by one-third where used with the alternative allowable stress design load combinations of Section 1605.2 that include wind or earthquake loads.

1806.2 Presumptive load-bearing values. The load-bearing values used in design for supporting soils and rock near the surface shall not exceed the values specified in Table 1806.2 unless data to substantiate the use of higher values are submitted and approved. Where the building official has reason to doubt the classification, strength or compressibility of the soil or rock, the requirements of Section 1803.5.2 shall be satisfied.

Presumptive load-bearing values shall apply to materials with similar physical and engineering characteristics. Mud, organic silt and organic clays (OL, OH), peat (Pt) and undocumented fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted.

Exception: A presumptive load-bearing capacity shall be permitted to be used where the building official deems the load-bearing capacity is adequate for the support of lightweight or temporary structures.

TABLE 1806.2—PRESUMPTIVE LOAD-BEARING VALUES

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction[a]	Cohesion (psf)[b]
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Cohesion value to be multiplied by the contact area, as limited by Section 1806.3.2.

1806.3 Lateral load resistance. Where the presumptive values of Table 1806.2 are used to determine resistance to lateral loads, the calculations shall be in accordance with Sections 1806.3.1 through 1806.3.4.

1806.3.1 Combined resistance. The total resistance to lateral loads shall be permitted to be determined by combining the values derived from the lateral bearing pressure and the lateral sliding resistance specified in Table 1806.2.

1806.3.2 Lateral sliding resistance limit. For clay, sandy clay, silty clay, clayey silt, silt and sandy silt, the lateral sliding resistance shall not exceed one-half the dead load.

1806.3.3 Increase for depth. The lateral bearing pressures specified in Table 1806.2 shall be permitted to be increased by the tabular value for each additional foot (305 mm) of depth to a value that is not greater than 15 times the tabular value.

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1806.3.4 Increase for poles. Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a $^1/_2$-inch (12.7 mm) motion at the ground surface due to short-term lateral loads shall be permitted to be designed using lateral bearing pressures equal to two times the tabular values.

SECTION 1807—FOUNDATION WALLS, RETAINING WALLS AND EMBEDDED POSTS AND POLES

1807.1 Foundation walls. Foundation walls shall be designed and constructed in accordance with Sections 1807.1.1 through 1807.1.6. Foundation walls shall be supported by foundations designed in accordance with Section 1808.

1807.1.1 Design lateral soil loads. Foundation walls shall be designed for the lateral soil loads set forth in Section 1610.

1807.1.2 Unbalanced backfill height. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height shall be permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

1807.1.3 Rubble stone foundation walls. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Foundation walls of rough or random rubble stone shall be not less than 16 inches (406 mm) thick. Rubble stone shall not be used for foundation walls of structures assigned to Seismic Design Category C, D, E or F.

1807.1.4 Permanent wood foundation systems. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Permanent wood foundation systems shall be designed and installed in accordance with AWC PWF. Lumber and plywood shall be preservative treated in accordance with AWPA U1 (Commodity Specification A, Special Requirement 4.2) and shall be identified in accordance with Section 2303.1.9.1.

1807.1.5 Concrete and masonry foundation walls. Concrete and masonry foundation walls shall be designed in accordance with Chapter 19 or 21, as applicable.

Exception: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Concrete and masonry foundation walls shall be permitted to be designed and constructed in accordance with Section 1807.1.6.

1807.1.6 Prescriptive design of concrete and masonry foundation walls. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Concrete and masonry foundation walls that are laterally supported at the top and bottom shall be permitted to be designed and constructed in accordance with this section.

1807.1.6.1 Foundation wall thickness. The thickness of prescriptively designed foundation walls shall be not less than the thickness of the wall supported, except that foundation walls of not less than 8-inch (203 mm) nominal width shall be permitted to support brick-veneered frame walls and 10-inch-wide (254 mm) cavity walls provided that the requirements of Section 1807.1.6.2 or 1807.1.6.3 are met.

1807.1.6.2 Concrete foundation walls. Concrete foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.2.
2. The size and spacing of vertical reinforcement shown in Table 1807.1.6.2 are based on the use of reinforcement with a minimum yield strength of 60,000 pounds per square inch (psi) (414 MPa). Vertical reinforcement with a minimum yield strength of 40,000 psi (276 MPa) or 50,000 psi (345 MPa) shall be permitted, provided that the same size bar is used and the spacing shown in the table is reduced by multiplying the spacing by 0.67 or 0.83, respectively.
3. Vertical reinforcement, where required, shall be placed nearest the inside face of the wall a distance, d, from the outside face (soil face) of the wall. The distance, d, is equal to the wall thickness, t, minus 1.25 inches (32 mm) plus one-half the bar diameter, d_b, [$d = t - (1.25 + d_b/2)$]. The reinforcement shall be placed within a tolerance of $\pm\,^3/_8$ inch (9.5 mm) where d is less than or equal to 8 inches (203 mm) or $\pm\,^1/_2$ inch (12.7 mm) where d is greater than 8 inches (203 mm).
4. In lieu of the reinforcement shown in Table 1807.1.6.2, smaller reinforcing bar sizes with closer spacings that provide an equivalent cross-sectional area of reinforcement per unit length shall be permitted.
5. Concrete cover for reinforcement measured from the inside face of the wall shall be not less than $^3/_4$ inch (19.1 mm). Concrete cover for reinforcement measured from the outside face of the wall shall be not less than $1^1/_2$ inches (38 mm) for No. 5 bars and smaller, and not less than 2 inches (51 mm) for larger bars.
6. Concrete shall have a specified compressive strength, f'_c, of not less than 2,500 psi (17.2 MPa).
7. The unfactored axial load per linear foot of wall shall not exceed $1.2\,tf'_c$ where t is the specified wall thickness in inches.

TABLE 1807.1.6.2—CONCRETE FOUNDATION WALLS[b, c]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[e] (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)								
		Design lateral soil load[a] (psf per foot of depth)								
		30[d]			45[d]			60		
		Minimum wall thickness (inches)								
		7.5	9.5	11.5	7.5	9.5	11.5	7.5	9.5	11.5
5	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC

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TABLE 1807.1.6.2—CONCRETE FOUNDATION WALLS[b, c]—continued

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[e] (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)								
		Design lateral soil load[a] (psf per foot of depth)								
		30[d]			45[d]			60		
		Minimum wall thickness (inches)								
		7.5	9.5	11.5	7.5	9.5	11.5	7.5	9.5	11.5
6	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	PC	PC	PC
7	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 48	PC	PC
	7	PC	PC	PC	#5 at 46	PC	PC	#6 at 48	PC	PC
8	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 43	PC	PC
	7	PC	PC	PC	#5 at 41	PC	PC	#6 at 43	PC	PC
	8	#5 at 47	PC	PC	#6 at 43	PC	PC	#6 at 32	#6 at 44	PC
9	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 39	PC	PC
	7	PC	PC	PC	#5 at 37	PC	PC	#6 at 38	#5 at 37	PC
	8	#5 at 41	PC	PC	#6 at 38	#5 at 37	PC	#7 at 39	#6 at 39	#4 at 48
	9[d]	#6 at 46	PC	PC	#7 at 41	#6 at 41	PC	#7 at 31	#7 at 41	#6 at 39
10	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 37	PC	PC
	7	PC	PC	PC	#6 at 48	PC	PC	#6 at 35	#6 at 48	PC
	8	#5 at 38	PC	PC	#7 at 47	#6 at 47	PC	#7 at 35	#7 at 47	#6 at 45
	9[d]	#6 at 41	#4 at 48	PC	#7 at 37	#7 at 48	#4 at 48	#6 at 22	#7 at 37	#7 at 47
	10[d]	#7 at 45	#6 at 45	PC	#7 at 31	#7 at 40	#6 at 38	#6 at 22	#7 at 30	#7 at 38

For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.2.

c. PC = Plain Concrete.

d. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable (see Section 1610).

e. For height of unbalanced backfill, see Section 1807.1.2.

1807.1.6.2.1 Seismic requirements. Based on the seismic design category assigned to the structure in accordance with Section 1613, concrete foundation walls designed using Table 1807.1.6.2 shall be subject to the following limitations:

1. Seismic Design Categories A and B. Not less than one No. 5 bar shall be provided around window, door and similar sized openings. The bar shall be anchored to develop f_y in tension at the corners of openings.
2. Seismic Design Categories C, D, E and F. Tables shall not be used except as allowed for plain concrete members in Section 1905.6.2.

1807.1.6.3 Masonry foundation walls. Masonry foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.3(1) for plain masonry walls or Table 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4) for masonry walls with reinforcement.
2. Vertical reinforcement shall have a minimum yield strength of 60,000 psi (414 MPa).
3. The specified location of the reinforcement shall equal or exceed the effective depth distance, d, noted in Tables 1807.1.6.3(2), 1807.1.6.3(3) and 1807.1.6.3(4) and shall be measured from the face of the exterior (soil) side of the wall to the center of the vertical reinforcement. The reinforcement shall be placed within the tolerances specified in TMS 602 for the specified location.
4. Grout shall comply with Section 2103.3.
5. Concrete masonry units shall comply with ASTM C90.
6. Clay masonry units shall comply with ASTM C652 for hollow brick, except compliance with ASTM C62 or ASTM C216 shall be permitted where solid masonry units are installed in accordance with Table 1807.1.6.3(1) for plain masonry.
7. Masonry units shall be laid in running bond and installed with Type M or S mortar in accordance with Section 2103.2.1.
8. The unfactored axial load per linear foot of wall shall not exceed $1.2\,tf'_m$ where t is the specified wall thickness in inches and f'_m is the specified compressive strength of masonry in pounds per square inch.

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9. Not less than 4 inches (102 mm) of solid masonry shall be provided at girder supports at the top of hollow masonry unit foundation walls.
10. Corbeling of masonry shall be in accordance with Section 2104.1. Where an 8-inch (203 mm) wall is corbeled, the top corbel shall not extend higher than the bottom of the floor framing and shall be a full course of headers not less than 6 inches (152 mm) in length or the top course bed joint shall be tied to the vertical wall projection. The tie shall be W2.8 (4.8 mm) and spaced at a maximum horizontal distance of 36 inches (914 mm). The hollow space behind the corbelled masonry shall be filled with mortar or grout.

TABLE 1807.1.6.3(1)—PLAIN MASONRY FOUNDATION WALLS[a, b, c]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[e] (feet)	MINIMUM NOMINAL WALL THICKNESS (inches)		
		Design lateral soil load[a] (psf per foot of depth)		
		30[f]	45[f]	60
7	4 (or less)	8	8	8
	5	8	10	10
	6	10	12	10 (solid[c])
	7	12	10 (solid[c])	10 (solid[c])
8	4 (or less)	8	8	8
	5	8	10	12
	6	10	12	12 (solid[c])
	7	12	12 (solid[c])	Note d
	8	10 (solid[c])	12 (solid[c])	Note d
9	4 (or less)	8	8	8
	5	8	10	12
	6	12	12	12 (solid[c])
	7	12(solid[c])	12 (solid[c])	Note d
	8	12(solid[c])	Note d	Note d
	9[f]	Note d	Note d	Note d

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.
b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.
c. Solid grouted hollow units or solid *masonry* units.
d. A design in compliance with Chapter 21 or reinforcement in accordance with Table 1807.1.6.3(2) is required.
e. For height of unbalanced backfill, see Section 1807.1.2.
f. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable (see Section 1610).

TABLE 1807.1.6.3(2)—8-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 5 INCHES[a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load[a] (psf per foot of depth)		
		30[e]	45[e]	60
7-4	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#4 at 48
	6-0	#4 at 48	#5 at 48	#5 at 48
	7-4	#5 at 48	#6 at 48	#7 at 48
8-0	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#4 at 48
	6-0	#4 at 48	#5 at 48	#5 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#5 at 48	#6 at 48	#7 at 48
8-8	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-8[e]	#6 at 48	#7 at 48	#8 at 48
9-4	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#6 at 48	#7 at 48	#8 at 48
	9-4[e]	#7 at 48	#8 at 48	#9 at 48

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TABLE 1807.1.6.3(2)—8-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 5 INCHES[a, b, c]—continued

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load[a] (psf per foot of depth)		
		30[e]	45[e]	60
10-0	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#6 at 48	#7 at 48	#8 at 48
	9-0[e]	#7 at 48	#8 at 48	#9 at 48
	10-10[e]	#7 at 48	#9 at 48	#9 at 48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.

c. For alternative reinforcement, see Section 1807.1.6.3.1.

d. For height of unbalanced backfill, see Section 1807.1.2.

e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

TABLE 1807.1.6.3(3)—10-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 6.75 INCHES[a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load[a] (psf per foot of depth)		
		30[e]	45[e]	60
7-4	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-4	#4 at 56	#5 at 56	#6 at 56
8-0	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
	8-0	#5 at 56	#6 at 56	#7 at 56
8-8	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
	8-8[e]	#5 at 56	#7 at 56	#8 at 56
9-4	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#5 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
	8-0	#5 at 56	#6 at 56	#7 at 56
	9-4[e]	#6 at 56	#7 at 56	#7 at 56
10-0	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#5 at 56	#5 at 56
	7-0	#5 at 56	#6 at 56	#7 at 56
	8-0	#5 at 56	#7 at 56	#8 at 56
	9-0[e]	#6 at 56	#7 at 56	#9 at 56
	10-0[e]	#7 at 56	#8 at 56	#9 at 56

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 1.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.

c. For alternative reinforcement, see Section 1807.1.6.3.1.

d. For height of unbalanced backfill, see Section 1807.1.2.

e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

TABLE 1807.1.6.3(4)—12-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 8.75 INCHES[a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load[a] (psf per foot of depth)		
		30[e]	45[e]	60
7-4	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-4	#4 at 72	#5 at 72	#6 at 72
8-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
	8-0	#5 at 72	#6 at 72	#8 at 72
8-8	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
	8-8[e]	#5 at 72	#7 at 72	#8 at 72
9-4	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
	8-0	#5 at 72	#6 at 72	#7 at 72
	9-4[e]	#6 at 72	#7 at 72	#8 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
	8-0	#5 at 72	#6 at 72	#7 at 72
	9-0[e]	#6 at 72	#7 at 72	#8 at 72
	10-0[e]	#7 at 72	#8 at 72	#9 at 72

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.

c. For alternative reinforcement, see Section 1807.1.6.3.1.

d. For height of unbalanced backfill, see Section 1807.1.2.

e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

1807.1.6.3.1 Alternative foundation wall reinforcement. In lieu of the reinforcement provisions for masonry foundation walls in Table 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4), alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per linear foot (mm) of wall shall be permitted to be used, provided that the spacing of reinforcement does not exceed 72 inches (1829 mm) and reinforcing bar sizes do not exceed No. 11.

1807.1.6.3.2 Seismic requirements. Based on the seismic design category assigned to the structure in accordance with Section 1613, masonry foundation walls designed using Tables 1807.2.5.

1. Seismic Design Categories A and B. No additional seismic requirements.
2. Seismic Design Category C. A design using Tables 1807.1.6.3(1) through 1807.1.6.3(4) is subject to the seismic requirements of Section 7.4.3 of TMS 402.
3. Seismic Design Category D. A design using Tables 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic requirements of Section 7.4.4 of TMS 402.
4. Seismic Design Categories E and F. A design using Tables 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic requirements of Section 7.4.5 of TMS 402.

> **1807.2 Retaining walls.** Retaining walls shall be designed in accordance with Sections 1807.2.1 through 1807.2.4.

1807.2.1 General. Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift.

1807.2.2 Design lateral soil loads. Retaining walls shall be designed for the lateral soil loads set forth in Section 1610. *[OSHPD 1R, 2 & 5] Retaining wall lateral soil loads determined by a geotechnical investigation report in accordance with Section 1803.5.12 and shall not be less than 80 percent of the lateral soil loads determined in accordance with Section 1610. For use with the load combina-*

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tions, lateral soil loads due to gravity load surcharge shall be considered gravity loads and seismic earth pressure increases due to earthquake shall be considered as seismic loads. For structures assigned to Seismic Design Category D, E or F, the design of retaining walls supporting more than 6 feet (1829 mm) of backfill height shall incorporate the additional seismic lateral earth pressure in accordance with the geotechnical investigation where required in Section 1803.2.

1807.2.3 Safety factor. Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605 shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake loads, 1.0 times other nominal loads, and investigation with one or more of the variable loads set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

Exception: Where earthquake loads are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

1807.2.4 Segmental retaining walls. Dry-cast concrete units used in the construction of segmental retaining walls shall comply with ASTM C1372.

1807.2.5 Guards. Guards shall be provided at retaining walls in accordance with Sections 1807.2.5.1 through 1807.2.5.3.

Exception: Guards are not required at retaining walls not accessible to the public.

1807.2.5.1 Where required. At retaining walls located within 36 inches (914mm) of walking surfaces, a guard shall be required between the walking surface and the open side of the retaining wall where the walking surface is located more than 30 inches (762 mm) measured vertically to the surface or grade below at any point within 36 inches (914mm) horizontally to the edge of the open side. Guards shall comply with Section 1607.9.

1807.2.5.2 Height. Required guards at retaining walls shall comply with the height requirements of Section 1015.3.

1807.2.5.3 Opening limitations. Required guards shall comply with the opening limitations of Section 1015.4.

1807.3 Embedded posts and poles. Designs to resist both axial and lateral loads employing posts or poles as columns embedded in earth or in concrete footings in earth shall be in accordance with Sections 1807.3.1 through 1807.3.3 or ASABE EP 486.3.

1807.3.1 Limitations. The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWPA U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

1807.3.2 Design criteria. The depth to resist lateral loads shall be determined using the design criteria established in Sections 1807.3.2.1 through 1807.3.2.3, or by other methods approved by the building official.

1807.3.2.1 Nonconstrained. The following formula shall be used in determining the depth of embedment required to resist lateral loads where lateral constraint is not provided at the ground surface, such as by a rigid floor or rigid ground surface pavement, and where lateral constraint is not provided above the ground surface, such as by a structural diaphragm.

Equation 18-1 $d = 0.5A\{1 + [1 + (4.36h/A)]^{1/2}\}$

where:

$A = 2.34P/(S_1 b)$.

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet (m) from ground surface to point of application of "P."

P = Applied lateral force in pounds (kN).

S_1 = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

1807.3.2.2 Constrained. The following formula shall be used to determine the depth of embedment required to resist lateral loads where lateral constraint is provided at the ground surface, such as by a rigid floor or slab-on-ground.

Equation 18-2 $$d = \sqrt{\frac{4.25Ph}{S_3 b}}$$

or alternatively

Equation 18-3 $$d = \sqrt{\frac{4.25M_g}{S_3 b}}$$

where:

M_g = Moment in the post at grade, in foot-pounds (kN-m).

S_3 = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

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1807.3.2.3 Vertical load. The resistance to vertical loads shall be determined using the vertical foundation pressure set forth in Table 1806.2.

1807.3.3 Backfill. The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with a specified compressive strength of not less than 2,000 psi (13.8 MPa). The hole shall be not less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.
2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (*CLSM*).

SECTION 1808—FOUNDATIONS

1808.1 General. Foundations shall be designed and constructed in accordance with Sections 1808.2 through 1808.9. Shallow foundations shall satisfy the requirements of Section 1809. Deep foundations shall satisfy the requirements of Section 1810.

1808.2 Design for capacity and settlement. Foundations shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is minimized. Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section 1808.6.

1808.3 Design loads. Foundations shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 2.3 or 2.4 of ASCE 7 or the alternative allowable stress design load combinations of Section 1605.2. The dead load is permitted to include the weight of foundations and overlying fill. Reduced live loads, as specified in Sections 1607.13 and 1607.14, shall be permitted to be used in the design of foundations.

1808.3.1 Seismic overturning. Where foundations are proportioned using the load combinations of Section 2.3 or 2.4 of ASCE 7 and the computation of seismic over-turning effects is by equivalent lateral force analysis or modal analysis, the proportioning shall be in accordance with Section 12.13.4 of ASCE 7.

1808.3.2 Surcharge. Fill or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or the surcharge. Existing footings or foundations that will be affected by any excavation shall be underpinned or otherwise protected against settlement and shall be protected against detrimental lateral or vertical movement or both.

Exception: Minor grading for landscaping purposes shall be permitted where done with walk-behind equipment, where the grade is not increased more than 1 foot (305 mm) from original design grade or where approved by the building official.

1808.4 Vibratory loads. Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbances of the soil.

1808.5 Shifting or moving soils. Where it is known that the shallow subsoils are of a shifting or moving character, foundations shall be carried to a sufficient depth to ensure stability.

1808.6 Design for expansive soils. Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808.6.1 or 1808.6.2.

Exceptions: Foundation design need not comply with Section 1808.6.1 or 1808.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808.6.3.
2. The building official approves stabilization of the soil in accordance with Section 1808.6.4.

1808.6.1 Foundations. Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

1808.6.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with WRI/CRSI or PTI DC 10.5. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with WRI/CRSI and post-tensioned slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with PTI DC 10.5. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

1808.6.3 Removal of expansive soil. Where expansive soil is removed in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804.5 or 1804.6.

Exception: Expansive soil need not be removed to the depth of constant moisture, provided that the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

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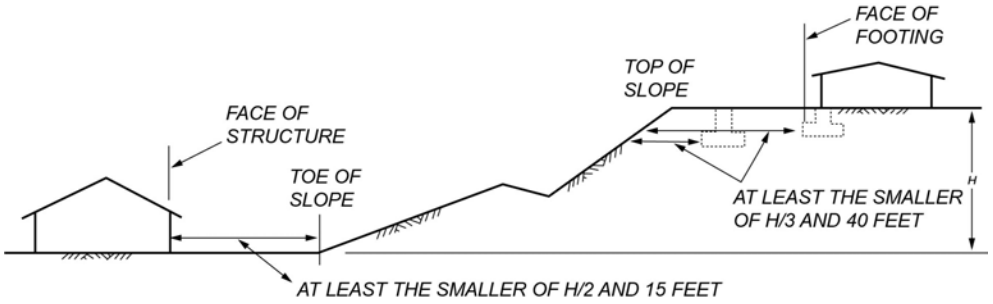
1808.6.4 Stabilization. Where the active zone of expansive soils is stabilized in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

1808.7 Foundations on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall comply with Sections 1808.7.1 through 1808.7.5.

1808.7.1 Building clearance from ascending slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section 1808.7.5 and Figure 1808.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

FIGURE 1808.7.1—FOUNDATION CLEARANCES FROM SLOPES


FACE OF FOOTING
TOP OF SLOPE
FACE OF STRUCTURE
TOE OF SLOPE
AT LEAST THE SMALLER OF H/3 AND 40 FEET
H
AT LEAST THE SMALLER OF H/2 AND 15 FEET

For SI: 1 foot = 304.8 mm.

1808.7.2 Foundation setback from descending slope surface. Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement. Except as provided for in Section 1808.7.5 and Figure 1808.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

1808.7.3 Pools. The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.

1808.7.4 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device not less than 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided that it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

1808.7.5 Alternate setback and clearance. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official shall be permitted to require a geotechnical investigation as set forth in Section 1803.5.10.

1808.8 Concrete foundations. The design, materials and construction of concrete foundations shall comply with Sections 1808.8.1 through 1808.8.6 and the provisions of Chapter 19.

Exception: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Where concrete footings supporting walls of light-frame construction are designed in accordance with Table 1809.7, a specific design in accordance with Chapter 19 is not required.

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1.

Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

TABLE 1808.8.1—MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to Seismic Design Category A, B or C ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*	2,500 psi
2a. Foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to Seismic Design Category D, E or F ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*	2,500 psi
2b. Foundations for other structures assigned to Seismic Design Category D, E or F	3,000 psi
3. Precast nonprestressed driven piles	4,000 psi
4. Socketed drilled shafts	4,000 psi
5. Micropiles	4,000 psi
6. Precast prestressed driven piles	5,000 psi
For SI: 1 pound per square inch = 0.00689 MPa.	

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1808.8.2 Concrete cover. The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be not less than the largest applicable value specified in Table 1808.8.2. Longitudinal bars spaced less than $1^1/_2$ inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section 20.5.1.3.5 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface.

TABLE 1808.8.2—MINIMUM CONCRETE COVER

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 20.5 of ACI 318
2. Precast nonprestressed deep foundation elements Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	 3 inches 2 inches In accordance with Section 20.5.1.3.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	 2.5 inches In accordance with Section 20.5.1.3.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI:1 inch = 25.4 mm.

1808.8.3 Placement of concrete. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-size foundation. Concrete shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted directly into smooth-sided pipes or tubes or placed in a rapid and continuous operation through a funnel hopper centered at the top of the element.

1808.8.4 Protection of concrete. Concrete foundations shall be protected from freezing during depositing and for a period of not less than 5 days thereafter. Water shall not be allowed to flow through the deposited concrete.

1808.8.5 Forming of concrete. Concrete foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require formwork. Where formwork is required, it shall be in accordance with Section 26.11 of ACI 318.

> **1808.8.6 Seismic requirements.** See Section 1905 for additional requirements for foundations of structures assigned to Seismic Design Category C, D, E or F.

For structures assigned to Seismic Design Category C, D, E or F, provisions of Section 18.13 of ACI 318 shall apply where not in conflict with the provisions of Sections 1808 through 1810.

Exception: ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Detached one- and two-family dwellings of light-frame construction and two stories or less above grade plane are not required to comply with the provisions of Section 18.13 of ACI 318.

➡ **1808.9 Vertical masonry foundation elements.** Vertical masonry foundation elements that are not foundation piers as defined in Section 202 shall be designed as piers, walls or columns, as applicable, in accordance with TMS 402.

SECTION 1809—SHALLOW FOUNDATIONS

1809.1 General. Shallow foundations shall be designed and constructed in accordance with Sections 1809.2 through 1809.13.

1809.2 Supporting soils. Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1804.6. CLSM shall be placed in accordance with Section 1804.7.

1809.3 Stepped footings. The top surface of footings shall be level. The bottom surface of footings shall be permitted to have a slope not exceeding 1 unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than 1 unit vertical in 10 units horizontal (10-percent slope).

[OSHPD 1R, 2 & 5] *Individual steps in continuous footings shall not exceed 18 inches (457 mm) in height and the slope of a series of such steps shall not exceed 1 unit vertical to 2 units horizontal (50-percent slope) unless otherwise recommended by a geotechnical report.*

The steps shall be detailed on the drawings. The local effects due to the discontinuity of the steps shall be considered in the design of the foundation.

1809.4 Depth and width of footings. The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809.5 shall be satisfied. The minimum width of footings shall be 12 inches (305 mm).

1809.5 Frost protection. Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality.
2. Constructing in accordance with ASCE 32.
3. Erecting on solid rock.

Exception: Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to Risk Category I.
2. Area of 600 square feet (56 m^2) or less for light-frame construction or 400 square feet (37 m^2) or less for other than light-frame construction.
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

1809.5.1 Frost protection at required exits. Frost protection shall be provided at exterior landings for all required exits with outward-swinging doors. Frost protection shall only be required to the extent necessary to ensure the unobstructed opening of the required exit doors.

1809.6 Location of footings. Footings on granular soil shall be so located that the line drawn between the lower edges of adjacent footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

1809.7 Prescriptive footings for light-frame construction. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Where a specific design is not provided, concrete or masonry-unit footings supporting walls of light-frame construction shall be permitted to be designed in accordance with Table 1809.7.

TABLE 1809.7—PRESCRIPTIVE FOOTINGS SUPPORTING WALLS OF LIGHT-FRAME CONSTRUCTION[a, b, c, d, e]

NUMBER OF FLOORS SUPPORTED BY THE FOOTING[f]	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	18	8[g]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Depth of footings shall be in accordance with Section 1809.4.
b. The ground under the floor shall be permitted to be excavated to the elevation of the top of the footing.
c. Interior stud-bearing walls shall be permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.
d. See Section 1905 for additional requirements for concrete footings of structures assigned to Seismic Design Category C, D, E or F.
e. For thickness of foundation walls, see Section 1807.1.6.
f. Footings shall be permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.
g. Plain concrete footings for Group R-3 occupancies shall be permitted to be 6 inches thick.

1809.8 Plain concrete footings. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* The edge thickness of plain concrete footings supporting walls of other than light-frame construction shall be not less than 8 inches (203 mm) where placed on soil or rock.

Exception: For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.

1809.9 Masonry-unit footings. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* The design, materials and construction of masonry-unit footings shall comply with Sections 1809.9.1 and 1809.9.2, and the provisions of Chapter 21.

Exception: Where a specific design is not provided, masonry-unit footings supporting walls of light-frame construction shall be permitted to be designed in accordance with Table 1809.7.

1809.9.1 Dimensions. Masonry-unit footings shall be laid in Type M or S mortar complying with Section 2103.2.1 and the depth shall be not less than twice the projection beyond the wall, pier or column. The width shall be not less than 8 inches (203 mm) wider than the wall supported thereon.

1809.9.2 Offsets. The maximum offset of each course in brick foundation walls stepped up from the footings shall be $1^1/_2$ inches (38 mm) where laid in single courses, and 3 inches (76 mm) where laid in double courses.

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1809.10 Pier and curtain wall foundations. Except in Seismic Design Categories D, E and F, pier and curtain wall foundations shall be permitted to be used to support light-frame construction not more than two stories above grade plane, provided that the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings bonded integrally with the exterior wall footings.
2. The minimum actual thickness of a load-bearing masonry wall shall be not less than 4 inches (102 mm) nominal or $3^5/_8$ inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced 6 feet (1829 mm) on center (o.c.).
3. Piers shall be constructed in accordance with Chapter 21 and the following:
   3.1. The unsupported height of the masonry piers shall not exceed 10 times their least dimension.
   3.2. Where structural clay tile or hollow concrete masonry units are used for piers supporting beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar.

   Exception: Unfilled hollow piers shall be permitted where the unsupported height of the pier is not more than four times its least dimension.
   3.3. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete or the cavities of the top course shall be filled with concrete or grout.
4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood frame walls and floors shall not be more than 4 feet (1219 mm) in height.
5. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry, nor 12 inches (305 mm) for hollow masonry.

1809.11 Steel grillage footings. Grillage footings of structural steel elements shall be separated with approved steel spacers and be entirely encased in concrete with not less than 6 inches (152 mm) on the bottom and not less than 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

1809.12 Timber footings. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Timber footings shall be permitted for buildings of Type V construction and as otherwise approved by the building official. Such footings shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B). Treated timbers are not required where placed entirely below permanent water level, or where used as capping for wood piles that project above the water level over submerged or marsh lands. The compressive stresses perpendicular to grain in untreated timber footings supported on treated piles shall not exceed 70 percent of the allowable stresses for the species and grade of timber as specified in the ANSI/AWC NDS.

1809.13 Footing seismic ties. Where a structure is assigned to Seismic Design Category D, E or F, individual spread footings founded on soil defined in Chapter 20 of ASCE 7 as Site Class E or F shall be interconnected by ties. Unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger footing design gravity load times the seismic coefficient, S_{DS}, divided by 10 and 25 percent of the smaller footing design gravity load.

1809.14 Grade beams. Grade beams shall comply with the provisions of ACI 318.

Exception: Grade beams not subject to differential settlement exceeding one-fourth of the thresholds specified in ASCE 7 Table 12.13-3 and designed to resist the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 need not comply with ACI 318 Section 18.13.3.1.

1809.15 Pipes and Trenches. [OSHPD 1R, 2 & 5] *Unless otherwise recommended by the soils report, open or backfilled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50-percent slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.*

Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.

> ***Exception:*** *Alternate trench locations and pipe clearances shall be permitted when approved by registered design professional and the enforcement agent.*

SECTION 1810—DEEP FOUNDATIONS

1810.1 General. Deep foundations shall be analyzed, designed, detailed and installed in accordance with Sections 1810.1 through 1810.4.

1810.1.1 Geotechnical investigation. Deep foundations shall be designed and installed on the basis of a geotechnical investigation as set forth in Section 1803.

1810.1.2 Use of existing deep foundation elements. Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the elements are sound and meet the requirements of this code. Such elements shall be load tested or redriven to verify their capacities. The design load applied to such elements shall be the lowest allowable load as determined by tests or redriving data.

1810.1.3 Deep foundation elements classified as columns. Deep foundation elements standing unbraced in air, water or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate lateral support is provided in accordance with Section 1810.2.1.

Exception: Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to design and construct such an element as a pedestal in accordance with ACI 318.

1810.1.4 Special types of deep foundations. The use of types of deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

1810.2 Analysis. The analysis of deep foundations for design shall be in accordance with Sections 1810.2.1 through 1810.2.5.

1810.2.1 Lateral support. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of deep foundation elements and to permit the design of the elements in accordance with accepted engineering practice and the applicable provisions of this code.

Where deep foundation elements stand unbraced in air, water or fluid soils, it shall be permitted to consider them laterally supported at a point 5 feet (1524 mm) into stiff soil or 10 feet (3048 mm) into soft soil unless otherwise approved by the building official on the basis of a geotechnical investigation by a registered design professional.

1810.2.2 Stability. Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more elements connected by a rigid cap shall be considered to be braced, provided that the elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-element group in a rigid cap shall be considered to be braced along the axis connecting the two elements. Methods used to brace deep foundation elements shall be subject to the approval of the building official.

Deep foundation elements supporting walls shall be placed alternately in lines spaced not less than 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the foundation elements are adequately braced to provide for lateral stability.

Exceptions:

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is not less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810.2.1 is provided for the entire height and analysis demonstrates that the element can support the required loads, including mislocations required by Section 1810.3.1.3, with neither harmful distortion nor instability in the structure.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided that the centers of the elements are located within the width of the supported wall.

1810.2.3 Settlement. The settlement of a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810.2.4 Lateral loads. The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as determined by a registered design professional. Where the ratio of the depth of embedment of the element to its least horizontal dimension is less than or equal to six, it shall be permitted to assume the element is rigid.

1810.2.4.1 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613.2.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

Exception: Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section:

1. Precast prestressed concrete piles detailed in accordance with Section 1810.3.8.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 as required by Section 1810.3.9.4.2.2.

1810.2.5 Group effects. The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element. Group effects shall be evaluated using a generally accepted method of analysis; the analysis for uplift of grouped elements with center-to-center spacing less than three times the least horizontal dimension of an element shall be evaluated in accordance with Section 1810.3.3.1.6.

1810.3 Design and detailing. Deep foundations shall be designed and detailed in accordance with Sections 1810.3.1 through 1810.3.13.

1810.3.1 Design conditions. Design of deep foundations shall include the design conditions specified in Sections 1810.3.1.1 through 1810.3.1.6, as applicable.

1810.3.1.1 Design methods for concrete elements. Where concrete deep foundations are laterally supported in accordance with Section 1810.2.1 for the entire height and applied forces cause bending moments not greater than those resulting from accidental eccentricities, structural design of the element using the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2 and the allowable stresses specified in this chapter shall be permitted. Otherwise, the structural design of concrete deep foundation elements shall use the strength load combinations specified in ASCE 7, Section 2.3 and approved strength design methods.

1810.3.1.2 Composite elements. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load in each section shall be limited by the structural capacity of that section.

1810.3.1.3 Mislocation. The foundation or superstructure shall be designed to resist the effects of the mislocation of any deep foundation element by not less than 3 inches (76 mm). To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

1810.3.1.4 Driven piles. Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

1810.3.1.5 Helical piles. Helical piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

1810.3.1.5.1 Helical piles seismic requirements. [OSHPD 1R, 2 & 5] *For structures assigned to Seismic Design Category D, E or F, capacities of helical piles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of helical pile. At least two percent of all production piles shall be proof tested to design strength determined by using load combinations in ASCE 7, Section 2.3.6.*

Helical piles shall satisfy corrosion resistance requirements of ICC-ES AC 358. In addition, all helical pile materials that are subject to corrosion shall include at least $^{1}/_{16}$ inch corrosion allowance.

Helical piles shall not be considered as carrying any horizontal loads.

1810.3.1.6 Casings. Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently watertight to exclude any foreign materials during the placing of concrete. Where a permanent casing is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1810.3.2.5. Horizontal joints in the casing shall be spliced in accordance with Section 1810.3.6.

1810.3.2 Materials. The materials used in deep foundation elements shall satisfy the requirements of Sections 1810.3.2.1 through 1810.3.2.8, as applicable.

1810.3.2.1 Concrete. Where concrete is cast in a steel pipe or where an enlarged base is formed by compacting concrete, the maximum size for coarse aggregate shall be $^{3}/_{4}$ inch (19.1 mm). Concrete to be compacted shall have a zero slump.

1810.3.2.1.1 Seismic hooks. For structures assigned to Seismic Design Category C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.

1810.3.2.1.2 ACI 318 Equation (25.7.3.3). Where this chapter requires detailing of concrete deep foundation elements in accordance with Section 18.7.5.4 of ACI 318, compliance with Equation (25.7.3.3) of ACI 318 shall not be required.

1810.3.2.2 Prestressing steel. Prestressing steel shall conform to ASTM A416.

1810.3.2.3 Steel. Structural steel H-piles and structural steel sheet piling shall conform to the material requirements in ASTM A6. Steel pipe piles shall conform to the material requirements in ASTM A252. Fully welded steel piles shall be fabricated from plates that conform to the material requirements in ASTM A36, ASTM A283, ASTM A572, ASTM A588 or ASTM A690.

1810.3.2.4 Timber. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Timber deep foundation elements shall be designed as piles or poles in accordance with ANSI/AWC NDS. Round timber elements shall conform to ASTM D25. Sawn timber elements shall conform to DOC PS-20.

1810.3.2.4.1 Preservative treatment. Timber deep foundation elements used to support permanent structures shall be treated in accordance with this section unless it is established that the tops of the untreated timber elements will be below the lowest ground-water level assumed to exist during the life of the structure. Preservative and minimum final retention shall be in accordance with AWPA U1 (Commodity Specification E, Use Category 4C) for round timber elements and AWPA U1 (Commodity Specification A, Use Category 4B) for sawn timber elements. Preservative-treated timber elements shall be subject to a quality control program administered by an approved agency. Element cutoffs shall be treated in accordance with AWPA M4.

1810.3.2.5 Protection of materials. Where boring records or site conditions indicate possible deleterious action on the materials used in deep foundation elements because of soil constituents, changing water levels or other factors, the elements shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the elements so as not to be rendered ineffective by installation. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

1810.3.2.6 Allowable stresses. The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810.3.2.6.

TABLE 1810.3.2.6—ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS[a]
1. Concrete or grout in compression[b]	
Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7 or Section 1810.3.5.3.4	$0.4 f'_c$
Cast-in-place in other permanent casing or rock	$0.33 f'_c$
Cast-in-place without a permanent casing	$0.3 f'_c$
Precast nonprestressed	$0.33 f'_c$
Precast prestressed	$0.33 f'_c - 0.27 f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4 f_y \le 30{,}000$ psi
3. Steel in compression	
Cores within concrete-filled pipes or tubes	$0.5 F_y \le 32{,}000$ psi
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5 F_y \le 32{,}000$ psi
Pipes or tubes for micropiles	$0.4 F_y \le 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35 F_y \le 24{,}000$ psi
Helical piles	$0.6 F_y \le 0.5 F_u$
4. Nonprestressed reinforcement in tension	
Within micropiles	$0.6 f_y$
Other conditions	
For load combinations that do not include wind or seismic loads	$0.5 f_y \le 30{,}000$ psi
For load combinations that include wind or seismic loads	$0.5 f_y \le 40{,}000$ psi
5. Steel in tension	
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5 F_y \le 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35 F_y \le 24{,}000$ psi
Helical piles	$0.6 F_y \le 0.5 F_u$
6. Timber	In accordance with the ANSI/AWC NDS

a. f'_c is the specified compressive strength of the concrete or grout; f_{pc} is the compressive stress on the gross concrete section due to effective prestress forces only; f_y is the specified yield strength of reinforcement; F_y is the specified minimum yield stress of steel; F_u is the specified minimum tensile stress of structural steel.

b. The stresses specified apply to the gross cross-sectional area of the concrete for precast prestressed piles and to the net cross-sectional area for all other piles. Where a temporary or permanent casing is used, the inside face of the casing shall be considered the outer edge of the concrete cross-section.

1810.3.2.7 Increased allowable compressive stress for cased mandrel-driven cast-in-place elements. The allowable compressive stress in the concrete shall be permitted to be increased as specified in Table 1810.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:

1. The design shall not use the casing to resist any portion of the axial load imposed.
2. The casing shall have a sealed tip and be mandrel driven.
3. The thickness of the casing shall be not less than manufacturer's standard gage No. 14 (0.068 inch) (1.75 mm).
4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.
5. The ratio of steel yield strength *(F_y)* to specified compressive strength *(f'_c)* shall be not less than six.
6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).

1810.3.2.8 Justification of higher allowable stresses. Use of allowable stresses in Table 1810.3.2.6 that must be justified in accordance with this section shall be permitted where supporting data justifying such higher stresses is submitted to and approved by the building official. Such substantiating data shall include the following:

1. A geotechnical investigation in accordance with Section 1803.
2. Load tests in accordance with Section 1810.3.3.1.2, regardless of the load supported by the element.

The design and installation of the deep foundation elements shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations who shall submit a report to the building official stating that the elements as installed satisfy the design criteria.

1810.3.3 Determination of allowable loads. The allowable axial and lateral loads on deep foundation elements shall be determined by an approved formula, load tests or method of analysis.

1810.3.3.1 Allowable axial load. The allowable axial load on a deep foundation element shall be determined in accordance with Sections 1810.3.3.1.1 through 1810.3.3.1.9.

Exception: Where approved by the building official, load testing is not required.

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1810.3.3.1.1 Driving criteria. The allowable compressive load on any driven deep foundation element where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate driveability for both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section 1810.3.3.1.2. The formula or wave equation load shall be determined for gravity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven elements. The use of a follower is permitted only with the approval of the building official. The introduction of fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

1810.3.3.1.2 Load tests. Where design compressive loads are greater than those determined using the allowable stresses specified in Section 1810.3.2.6, where the design load for any deep foundation element is in doubt, or where cast-in-place deep foundation elements have an enlarged base formed either by compacting concrete or by driving a precast base, control test elements shall be tested in accordance with ASTM D1143 or ASTM D4945. One element or more shall be load tested in each area of uniform subsoil conditions. Where required by the building official, additional elements shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test element as assessed by one of the published methods listed in Section 1810.3.3.1.3 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design professional with consideration given to tolerable total and differential settlements at design load in accordance with Section 1810.2.3. In subsequent installation of the balance of deep foundation elements, all elements shall be deemed to have a supporting capacity equal to that of the control element where such elements are of the same type, size and relative length as the test element; are installed using the same or comparable methods and equipment as the test element; are installed in similar subsoil conditions as the test element; and, for driven elements, where the rate of penetration (for example, net displacement per blow) of such elements is equal to or less than that of the test element driven with the same hammer through a comparable driving distance.

1810.3.3.1.3 Load test evaluation methods. It shall be permitted to evaluate load tests of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90-percent Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

1810.3.3.1.4 Allowable shaft resistance. The assumed shaft resistance developed by any uncased cast-in-place deep foundation element shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1806.2, up to 500 psf (24 kPa), unless a greater value is allowed by the building official on the basis of a geotechnical investigation as specified in Section 1803 or a greater value is substantiated by a load test in accordance with Section 1810.3.3.1.2. Shaft resistance and end-bearing resistance shall not be assumed to act simultaneously unless determined by a geotechnical investigation in accordance with Section 1803.

1810.3.3.1.5 Uplift capacity of a single deep foundation element. Where required by the design, the uplift capacity of a single deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1810.3.3.1.2, using the results of load tests conducted in accordance with ASTM D3689, divided by a factor of safety of two.

Exception: Where uplift is due to wind or seismic loading, the minimum factor of safety shall be two where capacity is determined by an analysis and one and one-half where capacity is determined by load tests.

1810.3.3.1.6 Allowable uplift load of grouped *deep foundation* elements. For grouped deep foundation elements subjected to uplift, the allowable uplift load for the group shall be calculated by a generally accepted method of analysis. Where the deep foundation elements in the group are placed at a center-to-center spacing less than three times the least horizontal dimension of the largest single element, the allowable uplift load for the group is permitted to be calculated as the lesser of:

1. The proposed individual allowable uplift *load* times the number of elements in the group.
2. Two-thirds of the effective weight of the group and the soil contained within a block defined by the perimeter of the group and the length of the element, plus two-thirds of the ultimate shear resistance along the soil block.

1810.3.3.1.7 Load-bearing capacity. Deep foundation elements shall develop ultimate load capacities of not less than twice the design working loads in the designated load-bearing layers. Analysis shall show that soil layers underlying the designated load-bearing layers do not cause the load-bearing capacity safety factor to be less than two.

1810.3.3.1.8 Bent deep foundation elements. The load-bearing capacity of deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative element.

1810.3.3.1.9 Helical piles. The allowable axial design load, P_a, of helical piles shall be determined as follows:

Equation 18-4 $P_a = 0.5\,P_u$

where P_u is the least value of:

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1. Base capacity plus shaft resistance of the *helical pile*. The base capacity is equal to the sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum. The shaft resistance is equal to the area of the shaft above the uppermost helical bearing plate times the ultimate skin resistance.
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests where required by Section 1810.3.3.1.2. ***[OSHPD 1R, 2 & 5]*** *Load tests are required to determine the ultimate capacity.*
4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

1810.3.3.2 Allowable lateral load. Where required by the design, the lateral load capacity of a single deep foundation element or a group thereof shall be determined by an approved method of analysis or by lateral load tests to not less than twice the proposed design working load. The resulting allowable lateral load shall not be more than one-half of the load that produces a gross lateral movement of 1 inch (25 mm) at the lower of the top of the foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity. Group effects shall be evaluated where required by Section 1810.2.5.

1810.3.4 Subsiding soils or strata. Where deep foundation elements are installed through subsiding soils or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces potentially imposed on the elements by the subsiding upper strata.

Where the influence of subsiding soils or strata is considered as imposing loads on the element, the allowable stresses specified in this chapter shall be permitted to be increased where satisfactory substantiating data are submitted.

1810.3.5 Dimensions of deep foundation elements. The dimensions of deep foundation elements shall be in accordance with Sections 1810.3.5.1 through 1810.3.5.3, as applicable.

1810.3.5.1 Precast. The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square elements shall be chamfered.

1810.3.5.2 Cast-in-place or grouted-in-place. Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

1810.3.5.2.1 Cased. Cast-in-place or grouted-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

1810.3.5.2.2 Uncased. Cast-in-place or grouted-in-place deep foundation elements without a permanent casing shall have a specified diameter of not less than 12 inches (305 mm). The element length shall not exceed 30 times the specified diameter.

Exception: The length of the element is permitted to exceed 30 times the specified diameter, provided that the design and installation of the deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. The registered design professional shall submit a report to the building official stating that the elements were installed in compliance with the approved construction documents.

1810.3.5.2.3 Micropiles. Micropiles shall have a nominal diameter of 12 inches (305 mm) or less. The minimum diameter set forth elsewhere in Section 1810.3.5 shall not apply to micropiles.

1810.3.5.3 Steel. Steel deep foundation elements shall satisfy the requirements of this section.

1810.3.5.3.1 Structural steel H-piles. Sections of structural steel H-piles shall comply with the requirements for HP shapes in ASTM A6, or the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^{3}/_{8}$ inch (9.5 mm).

For structures assigned to Seismic Design Category D, E or F, design and detailing of H-piles shall also conform to the requirements of AISC 341.

1810.3.5.3.2 Fully welded steel piles fabricated from plates. Sections of fully welded steel piles fabricated from plates shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^{3}/_{8}$ inch (9.5 mm).

1810.3.5.3.3 Structural steel sheet piling. Individual sections of structural steel sheet piling shall conform to the profile indicated by the manufacturer, and shall conform to the general requirements specified by ASTM A6.

[OSHPD 1R, 2 & 5] *Installation of sheet piling shall satisfy inspection, monitoring and observation requirements in Sections 1812.6 and 1812.7.*

1810.3.5.3.4 Steel pipes and tubes. Steel pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). Where steel pipes or tubes are driven open ended, they shall have not less than 0.34 square inch (219 mm^2) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete-filled steel pipes or tubes in structures assigned to Seismic Design Category C, D, E or F shall have a wall thickness of not less than $^3/_{16}$ inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18 inches (457 mm), a wall thickness of not less than $^3/_8$ inch (9.5 mm) and a suitable steel driving shoe welded to the bottom; the diameter of the rock socket shall be approximately equal to the inside diameter of the casing.

Exceptions:

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. For mandrel-driven pipes or tubes, the minimum wall thickness shall be $^1/_{10}$ inch (2.5 mm).

1810.3.5.3.5 Helical piles. Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

1810.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Exception: For buildings assigned to Seismic Design Category A or B, splices need not comply with the 50-percent tension and bending strength requirements where justified by supporting data.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

1810.3.6.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F splices of deep foundation elements shall develop the lesser of the following:

1. The nominal strength of the deep foundation element.
2. The axial and shear forces and moments from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810.3.7 Top of element detailing at cutoffs. Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

1810.3.8 Precast concrete piles. Precast concrete piles shall be designed and detailed in accordance with ACI 318.

Exceptions:

1. For precast prestressed piles in Seismic Design Category C, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.4 of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_0. In such cases, minimum transverse reinforcement index shall be as specified in Section 13.4.5.6 of ACI 318. ***[OSHPD 1R, 2 & 5]*** *not permitted by OSHPD.*
2. For precast prestressed piles in Seismic Design Categories D through F and in Site Class A, B, BC, C, CD, D or DE sites, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.5(c) of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_0. In such cases, minimum transverse reinforcement shall be as specified in Section 13.4.5.6 of ACI 318. ***[OSHPD 1R, 2 & 5]*** *not permitted by OSHPD.*

   [OSHPD 1R, 2 & 5] Exception: *Where the axial load from seismic forces is amplified by the applicable overstrength factor, Ω_0, the axial load limits in Section 18.13.5.10.6 of ACI 318 may be increased by two times.*

1810.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through 1810.3.9.6.

1810.3.9.1 Design cracking moment. The design cracking moment (ϕM_n) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

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Equation 18-5 $\phi M_n = 3\sqrt{f'_c}S_m$

For SI: $\phi M_n = 0.25\sqrt{f'_c}S_m$

where:

f'_c = Specified compressive strength of concrete or grout, psi (MPa).

S_m = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm^3).

1810.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of ASCE 7, Section 2.3 exceeds the design cracking moment determined in accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced. Where reinforcement is required, it shall be in compliance with Chapter 20 of ACI 318.

1810.3.9.3 Placement of reinforcement. Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semifluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.
3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided that the construction method can be demonstrated to the satisfaction of the building official.

1810.3.9.4 Seismic reinforcement. Where a structure is assigned to Seismic Design Category C, reinforcement shall be provided in accordance with Section 1810.3.9.4.1. Where a structure is assigned to Seismic Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810.3.9.4.2.

Exceptions:

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load, E, to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810.2.1.
3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 2.3.6 or 2.4.5 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810.2.1.
4. Closed ties or spirals where required by Section 1810.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

1810.3.9.4.1 Seismic reinforcement in Seismic Design Category C. For structures assigned to Seismic Design Category C, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

Transverse reinforcement shall consist of closed ties or spirals with a minimum $^3/_8$ inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8-longitudinal-bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the reinforced length.

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than the manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810.3.9.4.2.1 or 1810.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2.1 Site Classes A through DE. For Site Class A, B, BC, C, CD, D or DE sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension of the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Table 18.10.6.4(g) of ACI 318 shall be permitted.

1810.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

1810.3.9.5 Belled drilled shafts. Where drilled shafts are belled at the bottom, the edge thickness of the bell shall be not less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1810.3.9.6 Socketed drilled shafts. Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall be not less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

1810.3.10 Micropiles. Micropiles shall be designed and detailed in accordance with Sections 1810.3.10.1 through 1810.3.10.4.

1810.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at

every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not less than their development length in tension in accordance with ACI 318.

1810.3.10.2 Materials. Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A615 Grade 60 or 75 or ASTM A722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of $^3/_{16}$ inch (4.8 mm). Splices shall comply with Section 1810.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

1810.3.10.3 Reinforcement. For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry not less than 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

1810.3.10.4 Seismic reinforcement. For structures assigned to Seismic Design Category C, a permanent steel casing shall be provided from the top of the micropile down to the point of zero curvature. For structures assigned to Seismic Design Category D, E or F, the micropile shall be considered as an alternative system in accordance with Section 104.2.3 *or 1.8.7, as applicable.* The alternative system design, supporting documentation and test data shall be submitted to the building official for review and approval.

1810.3.10.4.1 Seismic requirements. [OSHPD 1R, 2 & 5] *For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness of $^3/_8$ inch shall be provided from the top of the micropile down to a minimum of 120 percent of the point of zero curvature. Capacity of micropiles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of micropile. At least two percent of all production piles shall be proof tested to design strength determined by using load combinations in ASCE 7, Section 2.3.6.*

Steel casing length in soil shall be considered as unbonded and shall not be considered as contributing to friction. Casing shall provide confinement at least equivalent to hoop reinforcing required by ACI 318 Section 18.13.5.

Reinforcement shall have Class 1 corrosion protection in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors. Steel casing design shall include at least $^1/_{16}$-inch corrosion allowance.

Micropiles shall not be considered as carrying any horizontal loads.

1810.3.11 Pile caps. Pile caps shall conform with ACI 318 and this section. Pile caps shall be of reinforced concrete, and shall include all elements to which vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load, with the exception of a combined pile raft. ***[OSHPD 1R, 2 & 5]*** *A combined pile raft foundation shall be an alternative system.* The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend not less than 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

1810.3.11.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap in accordance with ACI 318.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

1810.3.11.2 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
   1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element.
   1.2. The nominal tensile strength of a steel element.
   1.3. The frictional force developed between the element and the soil multiplied by 1.3.

   Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.
2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.
3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exceptions:

1. Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7 Section 12.4.3 or 12.14.3.2.
2. Connections need not be provided where the foundation or supported structure does not rely on the tensile capacity of the piles for stability under the design seismic force. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810.3.12 Grade beams. Grade beams shall comply with the provisions of ACI 318.

Exception: Grade beams not subject to differential settlement exceeding one-fourth of the thresholds specified in ASCE 7 Table 12.13-3 and designed to resist the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 need not comply with ACI 318 Section 18.13.3.1.

1810.3.13 Seismic ties. Seismic ties shall comply with the provisions of ACI 318.

Exception: In Group R-3 and U occupancies of light-frame construction, deep foundation elements supporting foundation walls, isolated interior posts detailed so the element is not subject to lateral loads or exterior decks and patios are not subject to interconnection where the soils are of adequate stiffness, subject to the approval of the building official.

1810.4 Installation. Deep foundations shall be installed in accordance with Section 1810.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

1810.4.1 Structural integrity. Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that would adversely affect the structural integrity of adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

1810.4.1.1 Compressive strength of precast concrete piles. A precast concrete pile shall not be driven before the concrete has attained a compressive strength of not less than 75 percent of the specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1810.4.1.2 Shafts in unstable soils. Where cast-in-place deep foundation elements are formed through unstable soils, the open hole shall be stabilized by a casing, slurry or other approved method prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

1810.4.1.3 Driving near uncased concrete. Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless approved by the building official. If driving near uncased concrete elements causes the concrete surface in any completed element to rise or drop significantly or bleed additional water, the completed element shall be replaced.

1810.4.1.4 Driving near cased concrete. Deep foundation elements shall not be driven within four and one-half average diameters of a cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in casings within heave range of driving.

1810.4.1.5 Defective timber piles. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.* Any substantial sudden change in rate of penetration of a timber pile shall be investigated for possible damage. If the sudden change in rate of penetration cannot be correlated to soil strata, the pile shall be removed for inspection or rejected.

1810.4.2 Identification. Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

1810.4.3 Location plan. A plan showing the location and designation of deep foundation elements by an identification system shall be filed with the building official prior to installation of such elements. Detailed records for elements shall bear an identification corresponding to that shown on the plan.

1810.4.4 Preexcavation. The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the elements already in place or damage adjacent structures. Element tips shall be advanced below the preexcavated depth until the required resistance or penetration is obtained.

1810.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2.

Exceptions:

1. The pile installation is completed by driving with an impact hammer in accordance with Section 1810.3.3.1.1.

2. The pile is to be used only for lateral resistance.

The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensures element capacities equal or exceeding those of the test elements.

1810.4.6 Heaved elements. Deep foundation elements that have heaved during the driving of adjacent elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the element shall be verified by load tests in accordance with Section 1810.3.3.1.2.

1810.4.7 Enlarged base cast-in-place elements. Enlarged bases for cast-in-place deep foundation elements formed by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. Such elements shall be constructed in the same manner as successful prototype test elements driven for the project. Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the shaft shall be filled sufficiently to reestablish lateral support by the soil. Where heave occurs, the element shall be replaced unless it is demonstrated that the element is undamaged and capable of carrying twice its design load.

1810.4.8 Hollow-stem augered, cast-in-place elements. Where concrete or grout is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. As the auger is withdrawn at a steady rate or in increments not to exceed 1 foot (305 mm), concreting or grouting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete or grout volumes shall be measured to ensure that the volume of concrete or grout placed in each element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any element is interrupted or a loss of concreting or grouting pressure occurs, the element shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than 12 hours old, unless approved by the building official. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

1810.4.9 Socketed drilled shafts. The rock socket and pipe or tube casing of socketed *drilled shafts* shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

1810.4.10 Micropiles. Micropile deep foundation elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a micropile or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means employed to ensure grout coverage outside the casing.

1810.4.11 Helical piles. Helical piles shall be installed to specified embedment depth and torsional resistance criteria as determined by a registered design professional. The torque applied during installation shall not exceed the manufacturer's rated maximum installation torque resistance of the helical pile.

1810.4.12 Special inspection. Special inspections in accordance with Sections 1705.7 and 1705.8 shall be provided for driven and cast-in-place deep foundation elements, respectively. Special inspections in accordance with Section 1705.9 shall be provided for helical piles.

SECTION 1811—PRESTRESSED ROCK AND SOIL FOUNDATION ANCHORS [OSHPD 1R, 2 & 5]

1811.1 General. *The requirements of this section address the use of vertical rock and soil anchors in resisting seismic or wind overturning forces, resulting in tension on shallow foundations.*

1811.2 Adoption. *Except for the modifications as set forth in Sections 1811.3 and 1811.4, all prestressed rock and soil foundation anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.*

1811.3 Geotechnical requirements*. The geotechnical report for the Prestressed Rock & Soil Foundation Anchors shall address the following:*

1. *Minimum diameter and minimum spacing for the anchors including consideration of group effects.*
2. *Maximum unbonded length and minimum bonded length of the tendon.*

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3. *Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.*
4. *Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress.*
5. *Anchor axial tension stiffness recommendations at the anticipated anchor axial tension displacements, when required for structural analysis.*
6. *Minimum grout pressure for installation and post-grout pressure.*
7. *Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.*
8. *Performance test shall be at a minimum of 1.6 times the design loads, but shall not exceed 80 percent of the specified minimum tensile strength of the tendons. There shall be a minimum of two preproduction test anchors. Preproduction test anchors shall be tested to ultimate load or a maximum of 0.80 times the specified minimum tensile strength of the tendon. A creep test is required for all prestressed anchors with greater than 10 kips of lock-off prestressing load.*
9. *Lock-off prestressing load requirements.*
10. *Acceptable drilling methods.*
11. *Geotechnical observation and monitoring requirements.*

***1811.4 Structural Requirements**.*

1. *Tendons shall be thread-bar anchors conforming to ASTM A722.*
2. *The anchors shall be placed vertical.*
3. *Design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.*
4. *Ultimate load shall be based upon the lesser of the strength of the superstructure elements, the maximum forces from a fully yielded structural system and forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3 and shall not exceed 80 percent of the specified minimum tensile strength of the tendons.*
5. *The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge by group effect.*
6. *Foundation design shall incorporate the effect of lock-off loads.*
7. *Design shall account for as-built locations of soil anchors considering all the acceptable construction tolerances.*
8. *Design shall account for both short- and long-term deformation.*
9. *Enforcement agency may require consideration of anchor deformation in evaluating deformation compatibility or building drift where it may be significant.*

SECTION 1812—EARTH RETAINING SHORING [OSHPD 1R, 2 & 5]

***1812.1 General.** The requirements of this section shall apply to temporary and permanent earth-retaining shoring using soldier piles and lagging with or without tie-back anchors in soil or rock, only when existing or new facilities are affected. Shoring used as construction means and methods only, which does not affect existing or new facilities, is not regulated by this section and shall satisfy the requirements of the authorities having jurisdiction.*

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1812.2 through 1812.8.

***1812.2 Duration.** Shoring shall be considered temporary when elements of the shoring will be exposed to site conditions for a period of less than or equal to 2 years, and shall be considered permanent otherwise. Permanent shoring shall account for the increase in lateral soil pressure due to earthquake. At the end of the construction period, the existing and new structures shall not rely on the temporary shoring for support in anyway. Wood components shall not be used for permanent shoring lasting more than 2 years. Wood components of the temporary shoring that may affect the performance of permanent structure shall be removed after the shoring is no longer required.*

All components of the shoring shall have corrosion protection or preservative treatment for their expected duration. Wood components of the temporary shoring that will not be removed shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and compatible species in accordance with Section 5), and shall be identified in accordance with Section 2303.1.9.

***1812.3 Surcharge.** Surcharge pressure due to footings, traffic or other sources shall be considered in the design. If the footing surcharge is located within the semicircular distribution or bulb of earth pressure (when shoring is located close to a footing), lagging shall be designed for lateral earth pressure due to footing surcharge. Soil arching effects may be considered in the design of lagging. Underpinning of the footing may be used in lieu of designing the shoring and lagging for surcharge pressure. Alternatively, continuously contacting drilled pier shafts near the footings shall be permitted. The lateral surcharge design pressure shall be derived using Boussinesq equations modified for the distribution of stresses in an elastic medium due to a uniform, concentrated or line surface load as appropriate and soil arching effects.*

***1812.4 Design and testing.** Except for the modifications as set forth in Sections 1812.4.1 through 1812.4.3, all Prestressed Rock and Soil Tie-back Anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.*

***1812.4.1 Geotechnical requirements.** The geotechnical report for the earth retaining shoring shall address the following:*

1. *Minimum diameter and minimum spacing for the anchors including consideration of group effects.*
2. *Maximum unbonded length and minimum bonded length of the tie-back anchors.*

3. *Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.*
4. *Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress for the anchor. For permanent anchors, a minimum factor of safety of 2.0 shall be applied to the ground soil interface as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.6.*
5. *Minimum grout pressure for installation and post-grout pressure for the anchor. The presumptive post-grout pressure of 300 psi may be used for all soil types.*
6. *Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.*
7. *Performance test for the anchors shall be at a minimum of two times the design loads and shall not exceed 80 percent of the specified minimum tensile strength of the anchor rod. A creep test is required for all prestressed anchors that are performance tested. All production anchors shall be tested at 150 percent of design loads and shall not be greater than 70 percent of the specified minimum tensile strength of the anchor rod.*
8. *Earth pressure, surcharge pressure and the seismic increment of earth pressure loading, when applicable.*
9. *Maximum recommended lateral deformation at the top of the soldier pile, at the tie-back anchor locations and the drilled pier concrete shafts at the lowest grade level.*
10. *Allowable vertical soil bearing pressure, friction resistance and lateral passive soil resistance for the drilled pier concrete shafts and associated factors of safety for these allowable capacities.*
11. *Soil-pier shaft/pile interaction assumptions and lateral soil stiffness to be used in design for drilled pier concrete shaft or pile lateral loads.*
12. *Acceptable drilling methods.*
13. *Geotechnical observation and monitoring recommendations.*

***1812.4.2 Structural requirements**:*

1. *Tendons shall be thread-bar anchors conforming to ASTM A722.*
2. *Anchor design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.*
3. *The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge.*
4. *Design of shoring system shall account for as-built locations of soil anchors considering all specified construction tolerances in Section 1812.8*
5. *Design of shoring system shall account for both short- and long-term deformation.*

***1812.4.3 Testing of tie-back anchors**:*

1. *The geotechnical engineer shall keep a record at the job site of all test loads and total anchor movement and report their accuracy.*
2. *If a tie-back anchor initially fails the testing requirements, the anchor shall be permitted to be re-grouted and retested. If the anchor continues to fail, the followings steps shall be taken:*
    a. *The contractor shall determine the cause of failure: (variations of the soil conditions, installation methods, materials, etc.).*
    b. *The contractor shall propose a solution to remedy the problem. The proposed solution will need to be reviewed and approved by geotechnical engineer, shoring design engineer and the building official.*
3. *After a satisfactory test, each anchor shall be locked off in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors Section 8.4.*
4. *The shoring design engineer shall specify design loads for each anchor.*

***1812.5 Construction:** The construction procedure shall address the following:*

1. *Holes drilled for piles/tie-back anchors shall be done without detrimental loss of ground, sloughing or caving of materials and without endangering previously installed shoring members or existing foundations.*
2. *Drilling of earth anchor shafts for tie-backs shall occur when the drill bench reaches 2 to 3 feet below the level of the tie-back pockets.*
3. *Casing or other methods shall be used where necessary to prevent loss of ground and collapse of the hole.*
4. *Drill cuttings from the earth anchor shaft shall be removed prior to anchor installation.*
5. *Unless tremie methods are used, all water and loose materials shall be removed from the holes prior to installing piles/tie-backs.*
6. *Tie-back anchor rods with attached centralizing devices shall be installed into the shaft or through the drill casing. Centralizing devices shall not restrict movement of the grout.*
7. *After lagging installation, voids between lagging and soil shall be backfilled immediately to the full height of lagging.*
8. *The soldier piles shall be placed within specified tolerances in the drilled hole and braced against displacement during grouting. Shafts shall be filled with concrete up to the elevation shown on the construction documents. The remainder of the shaft shall be permitted to be filled with controlled low-strength material (CLSM), when permitted by the construction documents.*

Excavation for lagging shall not be started until concrete has achieved sufficient strength for all anticipated loads as determined by the shoring design engineer.

9. *Where boulders and/or cobbles have been identified in the geotechnical reports, the contractor shall be prepared to address boulders and/or cobbles that may be encountered during the drilling of soldier piles and tie-back anchors.*
10. *The grouting equipment shall produce grout free of lumps and indispensed cement. The grouting equipment shall be sized to enable the grout to be pumped in continuous operation. The mixer shall be capable of continuously agitating the grout.*
11. *The quantity of grout and grout pressure shall be recorded. The grout pressure shall be controlled to prevent excessive heave in soils or fracturing rock formations.*
12. *If post-grouting is required, post-grouting operation shall be performed after initial grout has set for 24 hours in the bond length only. Tie-backs shall be grouted over a sufficient length (anchor bond length) to transfer the maximum anchor force to the anchor grout.*
13. *Testing of anchors may be performed after post-grouting operations, provided that grout has reached a strength of 3,000 psi as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.11.*
14. *Anchor rods shall be tensioned straight and true. Excavation directly below the anchors shall not continue before those anchors are tested.*

1812.6 Inspection, survey monitoring and observation.

1. *The shoring design engineer or his designee shall make periodic inspections of the job site for the purpose of observing the installation of the shoring system, testing of tie-back anchors and monitoring of the survey.*
2. *Testing, inspection and observation shall be in accordance with testing, inspection and observation requirements approved by the building official. The following activities and materials shall be tested, inspected or observed by the special inspector and geotechnical engineer:*
   a. *Sampling and testing of concrete in soldier pile and tie-back anchor shafts.*
   b. *Fabrication of tie-back anchor pockets on soldier beams*
   c. *Installation and testing of tie-back anchors.*
   d. *Survey monitoring of soldier pile and tie-back load cells.*
   e. *Survey monitoring of existing buildings.*
3. *A complete and accurate record of all soldier pile locations, depths, concrete strengths, tie-back locations and lengths, tie-back grout strength, quantity of concrete per pile, quantity of grout per tie-back and applied tie-back loads shall be maintained by the special inspector and geotechnical engineer. The shoring design engineer shall be notified of any unusual conditions encountered during installation.*
4. *Calibration data for each test jack, pressure gauge and master pressure gauge shall be verified by the special inspector and geotechnical engineer. The calibration tests shall be performed by an independent testing laboratory and within 120 calendar days of the data submitted.*
5. *Monitoring points shall be established at the top and at the anchor heads of selected soldier piles and at intermediate intervals as considered appropriate by the geotechnical engineer.*
6. *Control points shall be established outside the area of influence of the shoring system to ensure the accuracy of the monitoring readings.*
7. *The periodic basis of shoring monitoring, at a minimum, shall be as follows:*
   a. *Initial monitoring shall be performed prior to any excavation.*
   b. *Once excavation has begun, the periodic readings shall be taken weekly until excavation reaches the estimated subgrade elevation and the permanent foundation is complete.*
   c. *If performance of the shoring is within established guidelines, shoring design engineer may permit the periodic readings to be biweekly. Once initiated, biweekly readings shall continue until the building slab at ground floor level is completed and capable of transmitting lateral loads to the permanent structure. Thereafter, readings can be monthly.*
   d. *Where the building has been designed to resist lateral earth pressures, the periodic monitoring of the soldier piles and adjacent structure can be discontinued once the ground floor diaphragm and subterranean portion of the structure is capable of resisting lateral soil loads and approved by the shoring design engineer, geotechnical engineer and the building official.*
   e. *Additional readings shall be taken when requested by special inspector, shoring design engineer, geotechnical engineer or the building official.*
8. *Monitoring readings shall be submitted to shoring design engineer, engineer in responsible charge, and the building official within 3 working days after they are conducted. Monitoring readings shall be accurate to within 0.01 feet. Results are to be submitted in tabular form showing at least the initial date of monitoring and reading, current monitoring date and reading and difference between the two readings.*
9. *If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $^1/_2$ inch or soldier piles movement reaches 1 inch all excavation activities shall be suspended. The geotechnical and shoring design engineers shall determine the cause of movement, if any, and recommend corrective measures, if necessary, before excavation continues.*

10. *If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $^{3}/_{4}$ inch or soldier piles movement reaches $1^{1}/_{2}$ inches all excavation activities shall be suspended until the causes, if any, can be determined. Supplemental shoring shall be devised to eliminate further movement and the building official shall review and approve the supplemental shoring before excavation continues.*
11. *Monitoring of tie-back anchor loads:*
    a. *Load cells shall be installed at the tie-back heads adjacent to buildings at maximum interval of 50 feet, with a minimum of one load cell per wall.*
    b. *Load cell readings shall be taken once a day during excavation and once a week during the remainder of construction.*
    c. *Load cell readings shall be submitted to the geotechnical engineer, shoring design engineer, engineer in responsible charge and the building official.*
    d. *Load cell readings can be terminated once the temporary shoring no longer provides support for the buildings.*

1812.7 Monitoring of existing OSHPD 1, 1R, 2, 4 and 5 structures.

1. *The contractor shall complete a written and photographic log of all existing OSHPD 1, 1R, 2, 4 & 5 structures within 100 feet or three times depth of shoring, prior to construction. A licensed surveyor shall document all existing substantial cracks in adjacent existing structures.*
2. *The contractor shall document the existing condition of wall cracks adjacent to shoring walls prior to start of construction.*
3. *The contractor shall monitor existing walls for movement or cracking that may result from adjacent shoring.*
4. *If excessive movement or visible cracking occurs, the contractor shall stop work and shore/reinforce excavation and contact the shoring design engineer and the building official.*
5. *Monitoring of the existing structure shall be at reasonable intervals as required by the registered design professional, subject to approval of the building official. Monitoring shall be performed by a licensed surveyor and shall consist of vertical and lateral movement of the existing structures. Prior to starting shoring installation a preconstruction meeting shall take place between the contractor, shoring design engineer, surveyor, geotechnical engineer and the building official to identify monitoring locations on existing buildings.*
6. *If in the opinion of the building official or shoring design engineer, monitoring data indicate excessive movement or other distress, all excavation shall cease until the geotechnical engineer and shoring design engineer investigate the situation and make recommendations for remediation or continuing.*
7. *All reading and measurements shall be submitted to the building official and shoring design engineer.*

1812.8 Tolerances. *The following tolerances shall be specified on the construction documents.*

1. *Soldier piles:*
    i. *Horizontal and vertical construction tolerances for the soldier pile locations.*
    ii. *Soldier pile plumbness requirements (angle with vertical line).*
2. *Tie-back anchors:*
    i. *Allowable deviation of anchor projected angle from specified vertical and horizontal design projected angle.*
    ii. *Anchor clearance to the existing/new utilities and structures.*

SECTION 1813—VIBRO STONE COLUMNS FOR GROUND IMPROVEMENT [OSHPD 1R, 2 & 5]

1813.1 General. *This section shall apply to Vibro Stone Columns (VSCs) for ground improvement using unbounded aggregate materials. Vibro stone column provisions in this section are intended to increase bearing capacity, reduce settlements and mitigate liquefaction for shallow foundations. These requirements shall not be used for grouted or bonded stone columns, ground improvement for deep foundation elements or changing site class. VSCs shall not be considered as a deep foundation element.*

Ground improvement shall be installed under the entire building/structure footprint and not under isolated foundation elements only.

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1813.2 through 1813.5.

1813.2 Geotechnical report. *The geotechnical report shall specify vibro stone column requirements to ensure uniformity in total and differential immediate settlement, long-term settlement and earthquake-induced settlement. The report shall address the following:*

1. *Soil compaction shall be sufficient to mitigate potential for liquefaction as described in California Geological Survey (CGS) Special Publication 117A (SP-117A): Guidelines for Evaluating and Mitigating Seismic Hazard in California.*
2. *The area replacement ratio for the compaction elements and the basis of its determination shall be explained. Minimum factor of safety for soil compaction shall be in accordance with SP-117A.*
3. *The depth of soil compaction elements and extent beyond the footprint of structures/foundation shall be defined. Extent beyond the foundation shall be half the depth of the VSCs with a minimum of 10' or an approved alternative.*
4. *The minimum diameter and maximum spacing of soil compaction elements shall be specified. VSCs shall not be less than 2 feet in diameter and center to center spacing shall not exceed 8 feet.*
5. *The modulus of subgrade reactions for shallow foundations shall account for the presence of compaction elements.*

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6. *The modulus of subgrade reactions, long-term settlement and post-earthquake settlement shall be specified along with expected total and differential settlements for design.*
7. *The acceptance criteria for friction cone and piezocone penetration testing in accordance with ASTM D5778 complemented by a standard penetration test (SPT) in accordance with ASTM D1586, if necessary, to verify soil improvement shall be specified*
8. *The requirements for special inspection and observation by the geotechnical engineer shall be specified.*
9. *A Final Verified Report (FVR) documenting the installation of the ground improvement system and confirming that the ground improvement acceptance criteria have been met shall be prepared by the geotechnical engineer and submitted to the enforcement agency for review and approval.*

1813.3 Shallow Foundations. *VSCs under the shallow foundation shall be located symmetrically around the centroid of the footing or load, and:*

1. *There shall be a minimum of four stone columns under each isolated or continuous/combined footing or an approved equivalent.*
2. *The VSCs or deep foundation elements shall not be used to resist tension or overturning uplift from the shallow foundations.*
3. *The foundation design for the shallow foundation shall consider the increased vertical stiffness of the VSCs as point supports for analysis, unless it is substantiated that the installation of the VSCs results in improvement of the surrounding soils such that the modulus of subgrade reaction, long-term settlement and post-earthquake settlement can be considered uniform throughout.*

1813.4 Installation. *VSCs shall be installed with vibratory probes. Vertical columns of compacted unbounded aggregate shall be formed through the soils to be improved by adding gravel near the tip of the vibrator and progressively raising and re-penetrating the vibrator, which will results in the gravel being pushed into the surrounding soil.*

Gravel aggregate for VSCs shall be well graded with a maximum size of 6 inches and not more than 10 percent smaller than $^{3}/_{8}$ inch after compaction.

1813.5 Construction Documents. *Construction documents for VSCs, at a minimum, shall include the following:*

1. *Size, depth and location of VSCs.*
2. *The extent of soil improvements along with building/structure foundation outlines.*
3. *Field verification requirements and acceptance criteria using CPT/SPT.*
4. *The locations where CPT/SPT shall be performed.*
5. *A Testing, Inspection and Observation (TIO) program indicating the inspection and observation required for the VSCs.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 18A – SOILS AND FOUNDATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter								X	X	X				X										
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

18*A*

SOILS AND FOUNDATIONS

User notes:

About this chapter: *Chapter 18A provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads from the structure above. Chapter 18A is applicable to structures regulated by the Division of the State Architect-Structural Safety—including public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Sections 1.9.2.1 [DSA-SS] and 1.9.2.2 [DSA-SS/CC])—and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development—including hospitals and correctional treatment centers (applications listed in Sections 1.10.1 [OSHPD 1] and 1.10.4 [OSHPD 4]).*

SECTION 1801*A*—GENERAL

1801*A*.1 Scope. The provisions of this chapter shall apply to building and foundation systems.

1801A.1.1 Application. *The scope of application of Chapter 18A is as follows:*

1. *Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings*
2. *Applications listed in Section 1.10.1 and 1.10.4 regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD).These applications include hospitals and correctional treatment centers.*

1801A.1.2 Amendments in this chapter. *OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:*

   [DSA-SS] *For applications listed in Section 1.9.2.1.*

   [DSA-SS/CC] *For applications listed in Section 1.9.2.2.*
2. *Office of Statewide Hospital Planning and Development:*

   [OSHPD 1] - *For applications listed in Section 1.10.1.*

   [OSHPD 4] - *For applications listed in Section 1.10.4.*

1801A.1.3 Reference to other chapters.

1801A.1.3.1 [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A and 22A, the provisions in Chapters 16, 19, 21 and 22, respectively shall apply instead as defined in Section 1.9.2.2. Referenced sections may not directly correlate, but the corresponding DSA-SS/CC sections to such references still apply.*

SECTION 1802*A*—DESIGN BASIS

1802*A*.1 General. Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605*A*.2. The quality and design of materials used structurally in excavations and foundations shall comply with the requirements specified in Chapters 16, 19, 21, 22 and 23. Excavations and fills shall comply with Chapter 33.

SECTION 1803*A*—GEOTECHNICAL INVESTIGATIONS

1803*A*.1 General. Geotechnical investigations shall be conducted in accordance with Section 1803*A*.2 and reported in accordance with Section *1803A.7. The classification and investigation of the soil shall be made under the responsible charge of a California registered geotechnical engineer. All recommendations contained in geotechnical and geohazard reports shall be subject to the approval of the enforcement agency. All reports shall be prepared and signed by a registered geotechnical engineer, a certified engineering geologist and a registered geophysicist, where applicable.*

1803*A*.2 Investigations required. Geotechnical investigations shall be conducted in accordance with Sections 1803*A*.3 through *1803A.6*.

Exceptions:

1. *Geotechnical reports are not required for one-story, wood-frame and light-steel-frame buildings of Type II or Type V construction and 4,000 square feet (371 m^2) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan. Allowable foundation and lateral soil pressure values may be determined from Table 1806A.2.*

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2. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

1803*A*.3 Basis of investigation. Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

1803*A*.3.1 Scope of investigation. The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

There shall not be less than one boring or exploration shaft for each 5,000 square feet (465 m^2) of building area at the foundation level with a minimum of two provided for any one building. A boring may be considered to reflect subsurface conditions relevant to more than one building, subject to the approval of the enforcement agency.

Borings shall be of sufficient size to permit visual examination of the soil in place or, in lieu thereof, cores shall be taken.

Borings shall be of sufficient depth and size to adequately characterize sub-surface conditions.

1803*A*.4 Qualified representative. The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on site during all boring or sampling operations.

1803*A*.5 Investigated conditions. Geotechnical investigations shall be conducted as indicated in Sections 1803*A*.5.1 through 1803*A*.5.12.

1803*A*.5.1 Classification. Soil materials shall be classified in accordance with ASTM D2487. Rock shall be classified in accordance with ASTM D5878.

1803*A*.5.2 Questionable soil and rock. Where the classification, strength, moisture sensitivity or compressibility of the soil or rock is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that a geotechnical investigation be conducted.

1803*A*.5.3 Expansive soil. In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D4318.
2. More than 10 percent of the soil particles pass a No.200 sieve (75 µm), determined in accordance with ASTM D6913.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D6913.
4. Expansion index greater than 20, determined in accordance with ASTM D4829.

1803*A*.5.4 Groundwater. A geotechnical investigation shall be performed to determine if:

1. Groundwater is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.
2. The groundwater depth will affect the design and construction of buildings and structures.

1803*A*.5.5 Deep foundations. Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data on which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.
2. Recommended center-to-center spacing of deep foundation elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

1803*A*.5.6 Rock strata. Where foundations are to be constructed on or in rock, the geotechnical investigation shall assess variations in rock strata depth, competency and load-bearing capacity.

1803*A*.5.7 Excavation near foundations. Where excavation will reduce support from any foundation, a registered design professional shall prepare an assessment of the structure as determined from examination of the structure, available design documents, available subsurface data, and, if necessary, excavation of test pits. The registered design professional shall determine the requirements for support and protection of any existing foundation and prepare site-specific plans, details and sequence of work

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for submission. Such support shall be provided by under-pinning, bracing, excavation retention systems or by other means acceptable to the building official.

1803*A*.5.8 Compacted fill material. Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

1803*A*.5.9 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

1803*A*.5.10 Alternate setback and clearance. Where setbacks or clearances other than those required in Section 1808*A*.7 are desired, the building official shall be permitted to require a geotechnical investigation by a registered design professional to demonstrate that the intent of Section 1808*A*.7 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

1803*A*.5.11 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, a geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.
3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

1803*A*.5.12 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, the geotechnical investigation required by Section 1803*A*.5.11 shall include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to design earthquake ground motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude and source characteristics consistent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on one of the following:
    2.1. A site-specific study in accordance with Chapter 21 of ASCE 7.
    2.2. In accordance with Section 11.8.3 of ASCE 7.
3. An assessment of potential consequences of liquefaction and soil strength loss including, but not limited to, the following:
    3.1. Estimation of total and differential settlement.
    3.2. Lateral soil movement.
    3.3. Lateral soil loads on foundations.
    3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction.
    3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations.
    3.6. Increases in soil lateral pressures on retaining walls.
    3.7. Flotation of buried structures.
4. Discussion of mitigation measures such as, but not limited to, the following:
    4.1. Selection of appropriate foundation type and depths.
    4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces.
    4.3. Ground stabilization.
    4.4. Any combination of these measures and how they shall be considered in the design of the structure.

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1803A.6 Geohazard reports. *Geohazard reports shall be required for all proposed construction.*

Exceptions:

1. *Reports are not required for one-story, wood-frame and light-steel-frame buildings of Type II or Type V construction and 4,000 square feet (371 m^2) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan.*
2. *Reports are not required for the following scopes of work in existing buildings: nonstructural alterations, voluntary structural alterations without foundation work, or structural repairs for damage not caused by an earthquake.* ***[OSHPD 1 & 4]*** *Incidental structural additions or alterations.*
3. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

The purpose of the geohazard report shall be to identify geologic and seismic conditions that may require project mitigations. The reports shall contain data which provide an assessment of the nature of the site and potential for earthquake damage based on appropriate investigations of the regional and site geology, project foundation conditions and the potential seismic shaking at the site. The report shall be prepared by a California-certified engineering geologist in consultation with a California-registered geotechnical engineer.

The preparation of the geohazard report shall consider the most recent CGS Note 48; Checklist for the Review of Engineering Geology and Seismology Reports for California Public School, Hospitals and Essential Services Buildings. In addition, the most recent version of CGS Special Publication 42: Earthquake Fault Zones, A Guide for Government Agencies, Property Owners / Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, shall be considered for project sites proposed within an Alquist-Priolo Earthquake Fault Zone. The most recent version of CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, shall be considered for project sites proposed within a Seismic Hazard Zone. All conclusions shall be fully supported by satisfactory data and analysis.

In addition to requirements in Sections 1803A.5.11 and 1803A.5.12, the report shall include, but need not be limited to, the following:

1. *Site geology.*
2. *Evaluation of the known active and potentially active faults, both regional and local.*
3. *Ground-motion parameters, as required by Sections 1613A and 1617A, and ASCE 7.*

***1803A.7 Geotechnical* reporting.** Where geotechnical investigations are required, a written report of the investigations shall be submitted to the building official by the permit applicant at the time of permit application. *The geotechnical report shall provide completed evaluations of the foundation conditions of the site and the potential geologic/seismic hazards affecting the site. The geotechnical report shall include, but shall not be limited to, site-specific evaluations of design criteria related to the nature and extent of foundation materials, groundwater conditions, liquefaction potential, settlement potential and slope stability. The report shall contain the results of the analyses of problem areas identified in the geohazard report. The geotechnical report shall incorporate estimates of the characteristics of site ground motion provided in the geohazard report.* This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered. *Historic high ground water elevations shall be addressed in the report to adequately evaluate liquefaction and settlement potential.*
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.
6. Expected total and differential settlement.
7. Deep foundation information in accordance with Section 1803*A*.5.5.
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803*A*.5.8.
10. Controlled low-strength material properties and testing in accordance with Section 1803*A*.5.9.
11. *The report shall consider the effects of stepped footings addressed in Section 1809A.3.*
12. *The report shall consider the effects of seismic hazards in accordance with Section 1803A.6 and shall incorporate the associated geohazard report.*

1803A.8 Geotechnical peer review. [DSA-SS and DSA-SS/CC] *When alternate foundations designs or ground improvements are employed or where slope stabilization is required, a qualified peer review by a California-licensed geotechnical engineer, in accordance with Section 322 of Part 10, Title 24, CCR, may be required by the enforcement agency. In Section 322 of Part 10, Title 24, CCR, where reference is made to structural or seismic-resisting system, it shall be replaced with geotechnical, foundation or ground improvement, as appropriate.*

SECTION 1804*A*—EXCAVATION, GRADING AND FILL

1804*A*.1 Excavation near foundations. Excavation for any purpose shall not reduce vertical or lateral support for any foundation or adjacent foundation without first underpinning or protecting the foundation against detrimental lateral or vertical movement, or both, in accordance with Section 1803*A*.5.7.

1804*A*.2 Underpinning. Where underpinning is chosen to provide the protection or support of adjacent structures, the underpinning system shall be designed and installed in accordance with provisions of this chapter and Chapter 33.

1804*A*.2.1 Underpinning sequencing. Underpinning shall be installed in a sequential manner that protects the neighboring structure and the working construction site. The sequence of installation shall be identified in the approved construction documents.

1804*A*.3 Placement of backfill. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted in a manner that does not damage the foundation or the waterproofing or dampproofing material.

Exception: CLSM need not be compacted.

1804*A*.4 Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 1 unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped not less than 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped not less than 2 percent away from the building.

Exceptions:

1. Where climatic or soil conditions warrant, the slope of the ground away from the building foundation shall be permitted to be reduced to not less than 1 unit vertical in 48 units horizontal (2-percent slope).
2. Impervious surfaces shall be permitted to be sloped less than 2 percent where the surface is a door landing or ramp that is required to comply with Section 1010.1.4, 1012.3 or 1012.6.1.

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

1804*A*.5 Grading and fill in flood hazard areas. In flood hazard areas established in Section 1612*A*.3, grading, fill, or both, shall not be approved:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of flood water and, as applicable, wave action.
2. In floodways, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a registered design professional in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in flood levels during the occurrence of the design flood.
3. In coastal high hazard areas, unless such fill is conducted or placed to avoid diversion of water and waves toward any building or structure.
4. Where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated that the cumulative effect of the proposed flood hazard area encroachment, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point.

1804*A*.6 Compacted fill material. Where shallow foundations will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803*A*.

Exception: Compacted fill material 12 inches (305 mm) in depth or less need not comply with an approved report, provided that the in-place dry density is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557. The compaction shall be verified by special inspection in accordance with Section 1705*A*.6.

1804*A*.7 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803*A*.

SECTION 1805*A*—DAMPPROOFING AND WATERPROOFING

1805*A*.1 General. Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and dampproofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1202.4.

1805*A*.1.1 Story above grade plane. Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be dampproofed in accordance with Section 1805*A*.2 and a foundation drain shall be installed in accordance with Section 1805*A*.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1803*A*.5.4, 1805*A*.3 and 1805*A*.4.1 shall not apply in this case.

1805*A*.1.2 Under-floor space. The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground

level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the under-floor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1803*A*.5.4, 1805*A*.2, 1805*A*.3 and 1805*A*.4 shall not apply in this case.

1805*A*.1.2.1 Flood hazard areas. For buildings and structures in flood hazard areas as established in Section 1612*A*.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on one side or more.

Exception: Under-floor spaces of Group R-3 buildings that meet the requirements of FEMA TB 11.

1805*A*.1.3 Ground-water control. Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with Section 1805*A*.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

1805*A*.2 Dampproofing. Where hydrostatic pressure will not occur as determined by Section 1803*A*.5.4, floors and walls shall be dampproofed in accordance with this section.

1805*A*.2.1 Floors. Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1805*A*.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805*A*.2.2 Walls. Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level.

Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m^2) of acrylic modified cement, $^1/_8$ inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C887, any of the materials permitted for waterproofing by Section 1805.3.2 or other approved methods or materials.

1805*A*.2.2.1 Surface preparation of walls. Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than $^3/_8$ inch (9.5 mm) of Portland cement mortar. The parging shall be coved at the footing.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

1805*A*.3 Waterproofing. Where the ground-water investigation required by Section 1803*A*.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805*A*.1.3, walls and floors shall be waterproofed in accordance with this section.

1805*A*.3.1 Floors. Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805*A*.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805*A*.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805*A*.3.2.1 Surface preparation of walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805*A*.2.2.1.

1805*A*.3.3 Joints and penetrations. Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made watertight utilizing approved methods and materials.

1805*A*.4 Subsoil drainage system. Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805*A*.1.3 shall be deemed adequate for lowering the ground-water table.

1805*A*.4.1 Floor base course. Floors of basements, except as provided for in Section 1805*A*.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.

1805*A*.4.2 Foundation drain. A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend not less than 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

1805*A*.4.3 Drainage discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *California Plumbing Code*.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

SECTION 1806*A*—PRESUMPTIVE LOAD-BEARING VALUES OF SOILS

1806*A*.1 Load combinations. The presumptive load-bearing values provided in Table 1806*A*.2 shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605*A*.2. The values of vertical foundation pressure and lateral bearing pressure given in Table 1806*A*.2 shall be permitted to be increased by one-third where used with the alternative allowable stress design load combinations of Section 1605*A*.2 that include wind or earthquake loads.

1806*A*.2 Presumptive load-bearing values. The load-bearing values used in design for supporting soils and rock near the surface shall not exceed the values specified in Table 1806*A*.2 unless data to substantiate the use of higher values are submitted and approved. Where the building official has reason to doubt the classification, strength or compressibility of the soil or rock, the requirements of Section 1803*A*.5.2 shall be satisfied.

Presumptive load-bearing values shall apply to materials with similar physical and engineering characteristics. Mud, organic silt and organic clays (OL, OH), peat (Pt) and undocumented fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted.

Exception: A presumptive load-bearing capacity shall be permitted to be used where the building official deems the load-bearing capacity is adequate for the support of lightweight or temporary structures.

TABLE 1806*A*.2—PRESUMPTIVE LOAD-BEARING VALUES

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction[a]	Cohesion (psf)[b]
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Cohesion value to be multiplied by the contact area, as limited by Section 1806*A*.3.2.

1806*A*.3 Lateral load resistance. Where the presumptive values of Table 1806*A*.2 are used to determine resistance to lateral loads, the calculations shall be in accordance with Sections 1806*A*.3.1 through 1806*A*.3.4.

1806*A*.3.1 Combined resistance. The total resistance to lateral loads shall be permitted to be determined by combining the values derived from the lateral bearing pressure and the lateral sliding resistance specified in Table 1806*A*.2.

1806*A*.3.2 Lateral sliding resistance limit. For clay, sandy clay, silty clay, clayey silt, silt and sandy silt, the lateral sliding resistance shall not exceed one-half the dead load.

1806*A*.3.3 Increase for depth. The lateral bearing pressures specified in Table 1806*A*.2 shall be permitted to be increased by the tabular value for each additional foot (305 mm) of depth to a value that is not greater than 15 times the tabular value.

1806*A*.3.4 Increase for poles. Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a $^1/_2$-inch (12.7 mm) motion at the ground surface due to short-term lateral loads shall be permitted to be designed using lateral bearing pressures equal to two times the tabular values.

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SECTION 1807*A*—FOUNDATION WALLS, RETAINING WALLS AND EMBEDDED POSTS AND POLES

1807*A*.1 Foundation walls. Foundation walls shall be designed and constructed in accordance with Sections 1807*A*.1.1 through 1807*A*.1.6. Foundation walls shall be supported by foundations designed in accordance with Section 1808*A*.

1807*A*.1.1 Design lateral soil loads. Foundation walls shall be designed for the lateral soil loads *determined by a geotechnical investigation, in accordance with Section 1803A.*

1807*A*.1.2 Unbalanced backfill height. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height shall be permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

1807*A*.1.3 Rubble stone foundation walls. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1807*A*.1.4 Permanent wood foundation systems. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1807*A*.1.5 Concrete and masonry foundation walls. Concrete and masonry foundation walls shall be designed in accordance with Chapter 19*A* or 21*A*, as applicable.

> **1807*A*.2 Retaining walls.** Retaining walls shall be designed in accordance with Sections 1807*A*.2.1 through 1807*A*.2.4.

1807*A*.2.1 General. Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift.

1807*A*.2.2 Design lateral soil loads. Retaining walls shall be designed for the lateral soil loads *determined by a geotechnical investigation in accordance with Section 1803A and shall not be less than eighty percent of the lateral soil loads determined in accordance with Section 1610A. For use with the load combinations, lateral soil loads due to gravity loads surcharge shall be considered gravity loads and seismic earth pressure increases due to earthquake shall be considered as seismic loads*. For structures assigned to Seismic Design Category D, E or F, the design of retaining walls supporting more than 6 feet (1829 mm) of backfill height shall incorporate the additional seismic lateral earth pressure in accordance with the geotechnical investigation where required in Section 1803*A*.2.

1807*A*.2.3 Safety factor. Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605*A* shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake loads, 1.0 times other nominal loads, and investigation with one or more of the variable loads set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

Exception: Where earthquake loads are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

1807*A*.2.4 Segmental retaining walls. Dry-cast concrete units used in the construction of segmental retaining walls shall comply with ASTM C1372.

>

1807*A*.2.5 Guards. Guards shall be provided at retaining walls in accordance with Sections 1807*A*.2.5.1 through 1807*A*.2.5.3.

Exception: Guards are not required at retaining walls not accessible to the public.

1807*A*.2.5.1 Where required. At retaining walls located within 36 inches (914mm) of walking surfaces, a guard shall be required between the walking surface and the open side of the retaining wall where the walking surface is located more than 30 inches (762 mm) measured vertically to the surface or grade below at any point within 36 inches (914mm) horizontally to the edge of the open side. Guards shall comply with Section 1607*A*.9.

1807*A*.2.5.2 Height. Required guards at retaining walls shall comply with the height requirements of Section 1015.3.

1807*A*.2.5.3 Opening limitations. Required guards shall comply with the opening limitations of Section 1015.4.

1807*A*.3 Embedded posts and poles. Designs to resist both axial and lateral loads employing posts or poles as columns embedded in earth or in concrete footings in earth shall be in accordance with Sections 1807*A*.3.1 through 1807*A*.3.3 or ASABE EP 486.3 *Chapter 8 using soil properties and acceptance criteria determined by the geotechnical engineer in accordance with Section 1803A.*

1807*A*.3.1 Limitations. The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWPA U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

1807*A*.3.2 Design criteria. The depth to resist lateral loads shall be determined using the design criteria established in Sections 1807*A*.3.2.1 through 1807*A*.3.2.3, or by other methods approved by the building official.

1807*A*.3.2.1 Nonconstrained. The following formula shall be used in determining the depth of embedment required to resist lateral loads where lateral constraint is not provided at the ground surface, such as by a rigid floor or rigid ground surface pavement, and where lateral constraint is not provided above the ground surface, such as by a structural diaphragm.

Equation 18*A*-1 $d = 0.5A\{1 + [1 + (4.36h/A)]^{1/2}\}$

where:

$A = 2.34P/(S_1 b)$.

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet (m) from ground surface to point of application of "P."

P = Applied lateral force in pounds (kN).

S_1 = Allowable lateral soil-bearing pressure as set forth in Section 1806*A*.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

1807*A*.3.2.2 Constrained. The following formula shall be used to determine the depth of embedment required to resist lateral loads where lateral constraint is provided at the ground surface, such as by a rigid floor or slab-on-ground.

Equation 18*A*-2 $$d = \sqrt{\frac{4.25Ph}{S_3 b}}$$

or alternatively

Equation 18*A*-3 $$d = \sqrt{\frac{4.25M_g}{S_3 b}}$$

where:

M_g = Moment in the post at grade, in foot-pounds (kN-m).

S_3 = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

1807*A*.3.2.3 Vertical load. The resistance to vertical loads shall be determined using the vertical foundation pressure set forth in Table 1806*A*.2.

1807*A*.3.3 Backfill. The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with a specified compressive strength of not less than 2,000 psi (13.8 MPa). The hole shall be not less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.
2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (CLSM).

SECTION 1808*A*—FOUNDATIONS

1808*A*.1 General. Foundations shall be designed and constructed in accordance with Sections 1808*A*.2 through 1808*A*.9. Shallow foundations shall satisfy the requirements of Section 1809*A*. Deep foundations shall satisfy the requirements of Section 1810*A*.

1808*A*.2 Design for capacity and settlement. Foundations shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is minimized. Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section 1808*A*.6.

The enforcing agency may require an analysis of foundation elements to determine subgrade deformations in order to evaluate their effect on the superstructure, including story drift.

1808*A*.3 Design loads. Foundations shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 2.3 or 2.4 of ASCE 7 or the alternative allowable stress design load combinations of Section 1605*A*.2. The dead load is permitted to include the weight of foundations and overlying fill. Reduced live loads, as specified in Sections 1607*A*.13 and 1607*A*.14, shall be permitted to be used in the design of foundations.

1808*A*.3.1 Seismic overturning. Where foundations are proportioned using the load combinations of Section 2.3 or 2.4 of ASCE 7 and the computation of seismic over-turning effects is by equivalent lateral force analysis or modal analysis, the proportioning shall be in accordance with Section 12.13.4 of ASCE 7.

1808*A*.3.2 Surcharge. Fill or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or the surcharge. Existing footings or foundations that will be affected by any excavation shall be underpinned or otherwise protected against settlement and shall be protected against detrimental lateral or vertical movement or both.

Exception: Minor grading for landscaping purposes shall be permitted where done with walk-behind equipment, where the grade is not increased more than 1 foot (305 mm) from original design grade or where approved by the building official.

1808*A*.4 Vibratory loads. Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbances of the soil.

1808*A*.5 Shifting or moving soils. Where it is known that the shallow subsoils are of a shifting or moving character, foundations shall be carried to a sufficient depth to ensure stability.

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1808*A*.6 Design for expansive soils. Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808*A*.6.1 or 1808*A*.6.2.

Exceptions: Foundation design need not comply with Section 1808*A*.6.1 or 1808*A*.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808*A*.6.3.
2. The building official approves stabilization of the soil in accordance with Section 1808*A*.6.4.

1808*A*.6.1 Foundations. Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

1808*A*.6.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with WRI/CRSI or PTI DC 10.5. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with WRI/CRSI and post-tensioned slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with PTI DC 10.5. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

1808*A*.6.3 Removal of expansive soil. Where expansive soil is removed in lieu of designing foundations in accordance with Section 1808*A*.6.1 or 1808*A*.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804*A*.5 or 1804*A*.6.

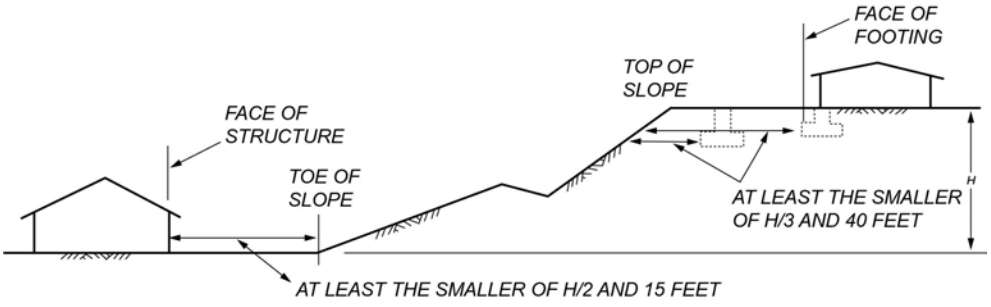
Exception: Expansive soil need not be removed to the depth of constant moisture, provided that the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

1808*A*.6.4 Stabilization. Where the active zone of expansive soils is stabilized in lieu of designing foundations in accordance with Section 1808*A*.6.1 or 1808*A*.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

1808*A*.7 Foundations on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall comply with Sections 1808*A*.7.1 through 1808*A*.7.5.

1808*A*.7.1 Building clearance from ascending slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section 1808*A*.7.5 and Figure 1808*A*.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

FIGURE 1808*A*.7.1—FOUNDATION CLEARANCES FROM SLOPES


FACE OF FOOTING
TOP OF SLOPE
FACE OF STRUCTURE
TOE OF SLOPE
AT LEAST THE SMALLER OF H/3 AND 40 FEET
H
AT LEAST THE SMALLER OF H/2 AND 15 FEET

For SI: 1 foot = 304.8 mm.

1808*A*.7.2 Foundation setback from descending slope surface. Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement. Except as provided for in Section 1808*A*.7.5 and Figure 1808*A*.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

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1808*A*.7.3 Pools. The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.

1808*A*.7.4 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device not less than 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided that it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

1808*A*.7.5 Alternate setback and clearance. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official shall be permitted to require a geotechnical investigation as set forth in Section 1803*A*.5.10.

1808*A*.8 Concrete foundations. The design, materials and construction of concrete foundations shall comply with Sections 1808*A*.8.1 through 1808*A*.8.6 and the provisions of Chapter 19*A*.

1808*A*.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808*A*.8.1.

Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

TABLE 1808*A*.8.1—MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to Seismic Design Category D, E or F	3,000 psi
2. Precast nonprestressed driven piles	4,000 psi
3. Socketed drilled shafts	4,000 psi
4. Micropiles	4,000 psi
5. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

1808*A*.8.2 Concrete cover. The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be not less than the largest applicable value specified in Table 1808*A*.8.2. Longitudinal bars spaced less than $1^1/_2$ inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section 20.5.1.3.5 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface.

TABLE 1808*A*.8.2—MINIMUM CONCRETE COVER

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 20.5 of ACI 318
2. Precast nonprestressed deep foundation elements Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	 3 inches 2 inches In accordance with Section 20.5.1.3.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	 2.5 inches In accordance with Section 20.5.1.3.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI:1 inch = 25.4 mm.

1808*A*.8.3 Placement of concrete. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-size foundation. Concrete shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted directly into smooth-sided pipes or tubes or placed in a rapid and continuous operation through a funnel hopper centered at the top of the element.

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1808*A*.8.4 Protection of concrete. Concrete foundations shall be protected from freezing during depositing and for a period of not less than 5 days thereafter. Water shall not be allowed to flow through the deposited concrete.

1808*A*.8.5 Forming of concrete. Concrete foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require formwork. Where formwork is required, it shall be in accordance with Section 26.11 of ACI 318.

1808*A*.8.6 Seismic requirements. See Section 1905*A* for additional requirements for foundations of structures assigned to Seismic Design Category D, E or F.

For structures assigned to Seismic Design Category D, E or F, provisions of Section 18.13 of ACI 318 shall apply where not in conflict with the provisions of Sections 1808*A* through 1810*A*.

1808*A*.9 Vertical masonry foundation elements. Vertical masonry foundation elements that are not foundation piers as defined in Section 202 shall be designed as piers, walls or columns, as applicable, in accordance with TMS 402.

SECTION 1809*A*—SHALLOW FOUNDATIONS

1809*A*.1 General. Shallow foundations shall be designed and constructed in accordance with Sections 1809*A*.2 through 1809*A*.*15*.

1809*A*.2 Supporting soils. Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1804*A*.6. CLSM shall be placed in accordance with Section 1804*A*.7.

1809*A*.3 Stepped footings. The top surface of footings shall be level. The bottom surface of footings shall be permitted to have a slope not exceeding 1 unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than 1 unit vertical in 10 units horizontal (10-percent slope).

Individual steps in continuous footings shall not exceed 18 inches (457 mm) in height and the slope of a series of such steps shall not exceed 1 unit vertical to 2 units horizontal (50 percent slope) unless otherwise recommended by a geotechnical report. The steps shall be detailed on the drawings. The local effects due to the discontinuity of the steps shall be considered in the design of the foundation.

1809*A*.4 Depth and width of footings. The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809*A*.5 shall be satisfied. The minimum width of footings shall be 12 inches (305 mm).

1809*A*.5 Frost protection. Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality.
2. Constructing in accordance with ASCE 32.
3. Erecting on solid rock.

Exception: Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to Risk Category I.
2. Area of 600 square feet (56 m^2) or less for light-frame construction or 400 square feet (37 m^2) or less for other than light-frame construction.
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

1809*A*.5.1 Frost protection at required exits. Frost protection shall be provided at exterior landings for all required exits with outward-swinging doors. Frost protection shall only be required to the extent necessary to ensure the unobstructed opening of the required exit doors.

1809*A*.6 Location of footings. Footings on granular soil shall be so located that the line drawn between the lower edges of adjacent footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

1809*A*.7 Prescriptive footings for light-frame construction. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809*A*.8 Plain concrete footings. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809*A*.9 Masonry-unit footings. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809*A*.10 Pier and curtain wall foundations. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809*A*.11 Steel grillage footings. Grillage footings of structural steel elements shall be separated with approved steel spacers and be entirely encased in concrete with not less than 6 inches (152 mm) on the bottom and not less than 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

1809*A*.12 Timber footings. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809*A*.13 Footing seismic ties. Where a structure is assigned to Seismic Design Category D, E or F, individual spread footings founded on soil defined in Chapter 20 of ASCE 7 as Site Class E or F shall be interconnected by ties. Unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, ties shall

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be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger footing design gravity load times the seismic coefficient, S_{DS}, divided by 10 and 25 percent of the smaller footing design gravity load.

1809*A*.14 Grade beams. Grade beams shall comply with the provisions of ACI 318.

Exception: Grade beams not subject to differential settlement exceeding one-fourth of the thresholds specified in ASCE 7 Table 12.13-3 and designed to resist the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 need not comply with ACI 318 Section 18.13.3.1.

1809A.15 Pipes and trenches. *Unless otherwise recommended by the soils report, open or backfilled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50 percent slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.*

Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.

Exception: *Alternate trench locations and pipe clearances shall be permitted when approved by registered design professional and the enforcement agent.*

SECTION 1810*A*—DEEP FOUNDATIONS

1810*A*.1 General. Deep foundations shall be analyzed, designed, detailed and installed in accordance with Sections 1810*A*.1 through 1810*A*.4.

1810*A*.1.1 Geotechnical investigation. Deep foundations shall be designed and installed on the basis of a geotechnical investigation as set forth in Section 1803*A*.

1810*A*.1.2 Use of existing deep foundation elements. Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the elements are sound and meet the requirements of this code. Such elements shall be load tested or redriven to verify their capacities. The design load applied to such elements shall be the lowest allowable load as determined by tests or redriving data.

1810*A*.1.3 Deep foundation elements classified as columns. Deep foundation elements standing unbraced in air, water or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate lateral support is provided in accordance with Section 1810*A*.2.1.

Exception: Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to design and construct such an element as a pedestal in accordance with ACI 318.

1810*A*.1.4 Special types of deep foundations. The use of types of deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

1810*A*.2 Analysis. The analysis of deep foundations for design shall be in accordance with Sections 1810*A*.2.1 through 1810*A*.2.5.

1810*A*.2.1 Lateral support. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of deep foundation elements and to permit the design of the elements in accordance with accepted engineering practice and the applicable provisions of this code.

Where deep foundation elements stand unbraced in air, water or fluid soils, it shall be permitted to consider them laterally supported at a point 5 feet (1524 mm) into stiff soil or 10 feet (3048 mm) into soft soil unless otherwise approved by the building official on the basis of a geotechnical investigation by a registered design professional.

1810*A*.2.2 Stability. Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more elements connected by a rigid cap shall be considered to be braced, provided that the elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-element group in a rigid cap shall be considered to be braced along the axis connecting the two elements. Methods used to brace deep foundation elements shall be subject to the approval of the building official.

Deep foundation elements supporting walls shall be placed alternately in lines spaced not less than 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the foundation elements are adequately braced to provide for lateral stability.

Exceptions:

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is not less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810*A*.2.1 is provided for the entire height and analysis demonstrates that the element can support the required loads, including mislocations required by Section 1810*A*.3.1.3, with neither harmful distortion nor instability in the structure.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided that the centers of the elements are located within the width of the supported wall.

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1810*A*.2.3 Settlement. The settlement of a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810*A*.2.4 Lateral loads. The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as determined by a registered design professional. Where the ratio of the depth of embedment of the element to its least horizontal dimension is less than or equal to six, it shall be permitted to assume the element is rigid.

1810*A*.2.4.1 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613*A*.2.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

Exception: Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section:

1. Precast prestressed concrete piles detailed in accordance with Section 1810*A*.3.8.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 as required by Section 1810*A*.3.9.4.2.2.

1810*A*.2.5 Group effects. The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element. Group effects shall be evaluated using a generally accepted method of analysis; the analysis for uplift of grouped elements with center-to-center spacing less than three times the least horizontal dimension of an element shall be evaluated in accordance with Section 1810*A*.3.3.1.6.

1810*A*.3 Design and detailing. Deep foundations shall be designed and detailed in accordance with Sections 1810*A*.3.1 through 1810*A*.3.13.

1810*A*.3.1 Design conditions. Design of deep foundations shall include the design conditions specified in Sections 1810*A*.3.1.1 through 1810*A*.3.1.6, as applicable.

1810*A*.3.1.1 Design methods for concrete elements. Where concrete deep foundations are laterally supported in accordance with Section 1810*A*.2.1 for the entire height and applied forces cause bending moments not greater than those resulting from accidental eccentricities, structural design of the element using the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605*A*.2 and the allowable stresses specified in this chapter shall be permitted. Otherwise, the structural design of concrete deep foundation elements shall use the strength load combinations specified in ASCE 7, Section 2.3 and approved strength design methods.

1810*A*.3.1.2 Composite elements. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load in each section shall be limited by the structural capacity of that section.

1810*A*.3.1.3 Mislocation. The foundation or superstructure shall be designed to resist the effects of the mislocation of any deep foundation element by not less than 3 inches (76 mm). To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

1810*A*.3.1.4 Driven piles. Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

1810*A*.3.1.5 Helical piles. Helical piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

1810A.3.1.5.1 Helical piles seismic requirements. *For structures assigned to Seismic Design Category D, E or F, capacities of helical piles shall be determined in accordance with Section 1810A.3.3 by at least two project-specific preproduction tests for each soil profile, size and depth of helical pile. At least two percent of all production piles shall be proof tested to the load determined in accordance with Section 1617A.1.15.*

Helical piles shall satisfy corrosion resistance requirements of ICC-ES AC 358. In addition, all helical pile materials that are subject to corrosion shall include at least $^{1}/_{16}$-inch corrosion allowance.

Helical piles shall not be considered as carrying any horizontal loads.

1810*A*.3.1.6 Casings. Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently watertight to exclude any foreign materials during the placing of concrete. Where a permanent casing is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1810*A*.3.2.5. Horizontal joints in the casing shall be spliced in accordance with Section 1810*A*.3.6.

1810*A*.3.2 Materials. The materials used in deep foundation elements shall satisfy the requirements of Sections 1810*A*.3.2.1 through 1810*A*.3.2.8, as applicable.

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1810*A*.3.2.1 Concrete. Where concrete is cast in a steel pipe or where an enlarged base is formed by compacting concrete, the maximum size for coarse aggregate shall be $^3/_4$ inch (19.1 mm). Concrete to be compacted shall have a zero slump.

1810*A*.3.2.1.1 Seismic hooks. For structures assigned to Seismic Design Category C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.

1810*A*.3.2.2 Prestressing steel. Prestressing steel shall conform to ASTM A416.

1810*A*.3.2.3 Steel. Structural steel H-piles and structural steel sheet piling shall conform to the material requirements in ASTM A6. Steel pipe piles shall conform to the material requirements in ASTM A252. Fully welded steel piles shall be fabricated from plates that conform to the material requirements in ASTM A36, ASTM A283, ASTM A572, ASTM A588 or ASTM A690.

1810*A*.3.2.4 Timber. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1810*A*.3.2.5 Protection of materials. Where boring records or site conditions indicate possible deleterious action on the materials used in deep foundation elements because of soil constituents, changing water levels or other factors, the elements shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the elements so as not to be rendered ineffective by installation. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

1810*A*.3.2.6 Allowable stresses. The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810*A*.3.2.6.

TABLE 1810*A*.3.2.6—ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS[a]
1. Concrete or grout in compression[b]	
Cast-in-place with a permanent casing in accordance with Section 1810*A*.3.2.7 or Section 1810*A*.3.5.3.4	$0.4 f'_c$
Cast-in-place in other permanent casing or rock	$0.33 f'_c$
Cast-in-place without a permanent casing	$0.3 f'_c$
Precast nonprestressed	$0.33 f'_c$
Precast prestressed	$0.33 f'_c - 0.27 f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4 f_y \le 30{,}000$ psi
3. Steel in compression	
Cores within concrete-filled pipes or tubes	$0.5 F_y \le 32{,}000$ psi
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5 F_y \le 32{,}000$ psi
Pipes or tubes for micropiles	$0.4 F_y \le 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35 F_y \le 24{,}000$ psi
Helical piles	$0.6 F_y \le 0.5 F_u$
4. Nonprestressed reinforcement in tension	
Within micropiles	$0.6 f_y$
Other conditions	
For load combinations that do not include wind or seismic loads	$0.5 f_y \le 30{,}000$ psi
For load combinations that include wind or seismic loads	$0.5 f_y \le 40{,}000$ psi
5. Steel in tension	
Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5 F_y \le 32{,}000$ psi
Other pipes, tubes or H-piles	$0.35 F_y \le 24{,}000$ psi
Helical piles	$0.6 F_y \le 0.5 F_u$
6. Timber	In accordance with the ANSI/AWC NDS

a. f'_c is the specified compressive strength of the concrete or grout; f_{pc} is the compressive stress on the gross concrete section due to effective prestress forces only; f_y is the specified yield strength of reinforcement; F_y is the specified minimum yield stress of steel; F_u is the specified minimum tensile stress of structural steel.

b. The stresses specified apply to the gross cross-sectional area of the concrete for precast prestressed piles and to the net cross-sectional area for all other piles. Where a temporary or permanent casing is used, the inside face of the casing shall be considered the outer edge of the concrete cross-section.

1810*A*.3.2.7 Increased allowable compressive stress for cased mandrel-driven cast-in-place elements. The allowable compressive stress in the concrete shall be permitted to be increased as specified in Table 1810*A*.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:

1. The design shall not use the casing to resist any portion of the axial load imposed.
2. The casing shall have a sealed tip and be mandrel driven.
3. The thickness of the casing shall be not less than manufacturer's standard gage No. 14 (0.068 inch) (1.75 mm).
4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.
5. The ratio of steel yield strength (F_y) to specified compressive strength (f'_c) shall be not less than six.
6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).

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1810*A*.3.2.8 Justification of higher allowable stresses. Use of allowable stresses in Table 1810*A*.3.2.6 that must be justified in accordance with this section shall be permitted where supporting data justifying such higher stresses is submitted to and approved by the building official. Such substantiating data shall include the following:

1. A geotechnical investigation in accordance with Section 1803*A*.
2. Load tests in accordance with Section 1810*A*.3.3.1.2, regardless of the load supported by the element.

The design and installation of the deep foundation elements shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations who shall submit a report to the building official stating that the elements as installed satisfy the design criteria.

1810*A*.3.3 Determination of allowable loads. The allowable axial and lateral loads on deep foundation elements shall be determined by an approved formula, load tests or method of analysis.

1810*A*.3.3.1 Allowable axial load. The allowable axial load on a deep foundation element shall be determined in accordance with Sections 1810*A*.3.3.1.1 through 1810*A*.3.3.1.9.

Exception: Where approved by the building official, load testing is not required.

1810*A*.3.3.1.1 Driving criteria. The allowable compressive load on any driven deep foundation element where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate driveability for both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section 1810*A*.3.3.1.2. The formula or wave equation load shall be determined for gravity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven elements. The use of a follower is permitted only with the approval of the building official. The introduction of fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

1810*A*.3.3.1.2 Load tests. Where design compressive loads are greater than those determined using the allowable stresses specified in Section 1810*A*.3.2.6, where the design load for any deep foundation element is in doubt, *where driven deep foundation elements are installed by means other than a pile hammer,* or where cast-in-place deep foundation elements have an enlarged base formed either by compacting concrete or by driving a precast base, control test elements shall be tested in accordance with ASTM D1143 or ASTM D4945. One element or more shall be load tested in each area of uniform subsoil conditions. Where required by the building official, additional elements shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test element as assessed by one of the published methods listed in Section 1810*A*.3.3.1.3 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design professional with consideration given to tolerable total and differential settlements at design load in accordance with Section 1810*A*.2.3. In subsequent installation of the balance of deep foundation elements, all elements shall be deemed to have a supporting capacity equal to that of the control element where such elements are of the same type, size and relative length as the test element; are installed using the same or comparable methods and equipment as the test element; are installed in similar subsoil conditions as the test element; and, for driven elements, where the rate of penetration (for example, net displacement per blow) of such elements is equal to or less than that of the test element driven with the same hammer through a comparable driving distance, *or where the downward pressure and torque on such elements is greater than or equal to that applied to the test element that determined the ultimate axial load capacity at a comparable driving distance.*

1810*A*.3.3.1.3 Load test evaluation methods. It shall be permitted to evaluate load tests of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90-percent Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

1810*A*.3.3.1.4 Allowable shaft resistance. The assumed shaft resistance developed by any uncased cast-in-place deep foundation element shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1806*A*.2, up to 500 psf (24 kPa), unless a greater value is allowed by the building official on the basis of a geotechnical investigation as specified in Section 1803*A* or a greater value is substantiated by a load test in accordance with Section 1810*A*.3.3.1.2. Shaft resistance and end-bearing resistance shall not be assumed to act simultaneously unless determined by a geotechnical investigation in accordance with Section 1803*A*.

1810*A*.3.3.1.5 Uplift capacity of a single deep foundation element. Where required by the design, the uplift capacity of a single deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1810*A*.3.3.1.2, using the results of load tests conducted in accordance with ASTM D3689 divided by a factor of safety of two.

Exception: Where uplift is due to wind or seismic loading, the minimum factor of safety shall be two where capacity is determined by an analysis and one and one-half where capacity is determined by load tests.

1810*A*.3.3.1.6 Allowable uplift load of grouped deep foundation elements. For grouped deep foundation elements subjected to uplift, the allowable uplift load for the group shall be calculated by a generally accepted method of analysis.

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Where the deep foundation elements in the group are placed at a center-to-center spacing less than three times the least horizontal dimension of the largest single element, the allowable uplift load for the group is permitted to be calculated as the lesser of:

1. The proposed individual allowable uplift load times the number of elements in the group.
2. Two-thirds of the effective weight of the group and the soil contained within a block defined by the perimeter of the group and the length of the element, plus two-thirds of the ultimate shear resistance along the soil block.

1810*A*.3.3.1.7 Load-bearing capacity. Deep foundation elements shall develop ultimate load capacities of not less than twice the design working loads in the designated load-bearing layers. Analysis shall show that soil layers underlying the designated load-bearing layers do not cause the load-bearing capacity safety factor to be less than two.

1810*A*.3.3.1.8 Bent deep foundation elements. The load-bearing capacity of deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative element.

1810*A*.3.3.1.9 Helical piles. The allowable axial design load, P_a, of helical piles shall be determined as follows:

Equation 18*A*-4 $P_a = 0.5\,P_u$

where P_u is the least value of:

1. Base capacity plus shaft resistance of the helical pile. The base capacity is equal to the sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum. The shaft resistance is equal to the area of the shaft above the uppermost helical bearing plate times the ultimate skin resistance.
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests.
4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

1810*A*.3.3.2 Allowable lateral load. Where required by the design, the lateral load capacity of a single deep foundation element or a group thereof shall be determined by an approved method of analysis or by lateral load tests *in accordance with ASTM D3966* to not less than twice the proposed design working load. The resulting allowable lateral load shall not be more than one-half of the load that produces a gross lateral movement of 1 inch (25 mm) at the lower of the top of the foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity. Group effects shall be evaluated where required by Section 1810*A*.2.5.

1810*A*.3.4 Subsiding soils or strata. Where deep foundation elements are installed through subsiding soils or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces potentially imposed on the elements by the subsiding upper strata.

Where the influence of subsiding soils or strata is considered as imposing loads on the element, the allowable stresses specified in this chapter shall be permitted to be increased where satisfactory substantiating data are submitted.

1810*A*.3.5 Dimensions of deep foundation elements. The dimensions of deep foundation elements shall be in accordance with Sections 1810*A*.3.5.1 through 1810*A*.3.5.3, as applicable.

1810*A*.3.5.1 Precast. The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square elements shall be chamfered.

1810*A*.3.5.2 Cast-in-place or grouted-in-place. Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

1810*A*.3.5.2.1 Cased. Cast-in-place or grouted-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

1810*A*.3.5.2.2 Uncased. Cast-in-place or grouted-in-place deep foundation elements without a permanent casing shall have a specified diameter of not less than 12 inches (305 mm). The element length shall not exceed 30 times the specified diameter.

Exception: The length of the element is permitted to exceed 30 times the specified diameter, provided that the design and installation of the deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. The registered design professional shall submit a report to the building official stating that the elements were installed in compliance with the approved construction documents.

1810*A*.3.5.2.3 Micropiles. Micropiles shall have a nominal diameter of 12 inches (305 mm) or less. The minimum diameter set forth elsewhere in Section 1810*A*.3.5 shall not apply to micropiles.

1810*A*.3.5.3 Steel. Steel deep foundation elements shall satisfy the requirements of this section.

1810*A*.3.5.3.1 Structural steel H-piles. Sections of structural steel H-piles shall comply with the requirements for HP shapes in ASTM A6, or the following:

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1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^3/_8$ inch (9.5 mm).

For structures assigned to Seismic Design Category D, E or F, design and detailing of H-piles shall also conform to the requirements of AISC 341.

1810*A*.3.5.3.2 Fully welded steel piles fabricated from plates. Sections of fully welded steel piles fabricated from plates shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^3/_8$ inch (9.5 mm).

1810*A*.3.5.3.3 Structural steel sheet piling. Individual sections of structural steel sheet piling shall conform to the profile indicated by the manufacturer, and shall conform to the general requirements specified by ASTM A6.

Installation of sheet piling shall satisfy inspection, monitoring and observation requirements in Sections 1812A.6 and 1812A.7.

1810*A*.3.5.3.4 Steel pipes and tubes. Steel pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). Where steel pipes or tubes are driven open ended, they shall have not less than 0.34 square inch (219 mm^2) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete-filled steel pipes or tubes in structures assigned to Seismic Design Category C, D, E or F shall have a wall thickness of not less than $^3/_{16}$ inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18 inches (457 mm), a wall thickness of not less than $^3/_8$ inch (9.5 mm) and a suitable steel driving shoe welded to the bottom; the diameter of the rock socket shall be approximately equal to the inside diameter of the casing.

Exceptions:

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. For mandrel-driven pipes or tubes, the minimum wall thickness shall be $^1/_{10}$ inch (2.5 mm).

1810*A*.3.5.3.5 Helical piles. Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

1810*A*.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810*A*.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

1810*A*.3.6.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F splices of deep foundation elements shall develop the lesser of the following:

1. The nominal strength of the deep foundation element.
2. The axial and shear forces and moments from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810*A*.3.7 Top of element detailing at cutoffs. Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

1810*A*.3.8 Precast concrete piles. Precast concrete piles shall be designed and detailed in accordance with ACI 318.

Exception: *Where the axial load from seismic forces is amplified by the applicable overstrength factor, Ω_0, the axial load limits in Section 18.13.5.10.6 of ACI 318 may be increased by two times.*

1810*A*.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810*A*.3.9.1 through 1810*A*.3.9.6.

1810*A*.3.9.1 Design cracking moment. The design cracking moment (ϕM_n) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

Equation 18*A*-5 $\phi M_n = 3\sqrt{f'_c}S_m$

For SI: $\phi M_n = 0.25\sqrt{f'_c}S_m$

where:

f'_c = Specified compressive strength of concrete or grout, psi (MPa).

S_m = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm^3).

1810*A*.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of ASCE 7, Section 2.3 exceeds the design cracking moment determined in accordance with Section 1810*A*.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced. Where reinforcement is required, it shall be in compliance with Chapter 20 of ACI 318.

1810*A*.3.9.3 Placement of reinforcement. Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semifluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.
3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided that the construction method can be demonstrated to the satisfaction of the building official.

1810*A*.3.9.4 Seismic reinforcement. Where a structure is assigned to Seismic Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810*A*.3.9.4.2.

Exceptions:

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810*A*.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load, E, to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810*A*.2.1.
3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810*A*.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 2.3.6 or 2.4.5 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810*A*.2.1.
4. Closed ties or spirals where required by Section 1810*A*.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

1810*A*.3.9.4.1 Seismic reinforcement in Seismic Design Category C. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1810*A*.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.

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4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810*A*.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810*A*.3.9.4.2.1 or 1810*A*.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810*A*.3.9.4.2.1 Site Classes A through DE. For Site Class A, B, BC, C, CD, D or DE sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension *at* the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Table 18.10.6.4(g) of ACI 318 shall be permitted *for concrete deep foundation elements.*

1810*A*.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension *at the bottom* of the pile cap and within seven times the least element dimension *at* the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

1810*A*.3.9.5 Belled drilled shafts. Where drilled shafts are belled at the bottom, the edge thickness of the bell shall be not less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1810*A*.3.9.6 Socketed drilled shafts. Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall be not less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

1810*A*.3.10 Micropiles. Micropiles shall be designed and detailed in accordance with Sections 1810*A*.3.10.1 through 1810*A*.3.10.4.

1810*A*.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not less than their development length in tension in accordance with ACI 318.

1810*A*.3.10.2 Materials. Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A615 Grade 60 or 75 or ASTM A722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of $^{3}/_{16}$ inch (4.8 mm). Splices shall comply with Section 1810*A*.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

1810*A*.3.10.3 Reinforcement. For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry not less than 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

1810A.3.10.4 Seismic requirements. *For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness of $^{3}/_{8}$ inch shall be provided from the top of the micropile down to a minimum of 120 percent of the point of zero curvature. Capacity of micropiles shall be determined in accordance with Section 1810A.3.3 by at least two project-specific preproduction tests for each soil profile, size and depth of micropile. At least two percent of all production piles shall be proof tested to the load determined in accordance with Section 1617A.1.15.*

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Steel casing length in soil shall be considered as unbonded and shall not be considered as contributing to friction. Casing shall provide confinement at least equivalent to hoop reinforcing required by ACI 318 Section 18.13.5.

Reinforcement shall have Class 1 corrosion protection in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors. Steel casing design shall include at least $^{1}/_{16}$-inch corrosion allowance.

Micropiles shall not be considered as carrying any horizontal loads.

1810*A*.3.11 Pile caps. Pile caps shall conform with ACI 318 and this section. Pile caps shall be of reinforced concrete, and shall include all elements to which vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load, with the exception of a combined pile raft. *A combined pile raft foundation shall be an alternate system.* The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend not less than 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

1810*A*.3.11.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap in accordance with ACI 318.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

1810*A*.3.11.2 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
   1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element.
   1.2. The nominal tensile strength of a steel element.
   1.3. The frictional force developed between the element and the soil multiplied by 1.3. ***[DSA-SS, DSA-SS/CC]*** *Not permitted by DSA.*

   Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.
2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.
3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

   Exception: Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7 Section 12.4.3 or 12.14.3.2.

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810*A*.3.12 Grade beams. Grade beams shall comply with the provisions of ACI 318.

Exception: Grade beams not subject to differential settlement exceeding one-fourth of the thresholds specified in ASCE 7 Table 12.13-3 and designed to resist the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 need not comply with ACI 318 Section 18.13.3.1.

1810*A*.3.13 Seismic ties. Seismic ties shall comply with the provisions of ACI 318.

Exception: In Group R-3 and U occupancies of light-frame construction, deep foundation elements supporting foundation walls, isolated interior posts detailed so the element is not subject to lateral loads or exterior decks and patios are not subject to interconnection where the soils are of adequate stiffness, subject to the approval of the building official.

1810*A*.4 Installation. Deep foundations shall be installed in accordance with Section 1810*A*.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

1810*A*.4.1 Structural integrity. Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that would adversely affect the structural integrity of adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

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1810*A*.4.1.1 Compressive strength of precast concrete piles. A precast concrete pile shall not be driven before the concrete has attained a compressive strength of not less than 75 percent of the specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1810*A*.4.1.2 Shafts in unstable soils. Where cast-in-place deep foundation elements are formed through unstable soils, the open hole shall be stabilized by a casing, slurry or other approved method prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

1810*A*.4.1.3 Driving near uncased concrete. Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless approved by the building official. If driving near uncased concrete elements causes the concrete surface in any completed element to rise or drop significantly or bleed additional water, the completed element shall be replaced.

1810*A*.4.1.4 Driving near cased concrete. Deep foundation elements shall not be driven within four and one-half average diameters of a cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in casings within heave range of driving.

1810*A*.4.1.5 Defective timber piles. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1810*A*.4.2 Identification. Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

1810*A*.4.3 Location plan. A plan showing the location and designation of deep foundation elements by an identification system shall be filed with the building official prior to installation of such elements. Detailed records for elements shall bear an identification corresponding to that shown on the plan.

1810*A*.4.4 Preexcavation. The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the elements already in place or damage adjacent structures. Element tips shall be advanced below the preexcavated depth until the required resistance or penetration is obtained.

1810*A*.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810*A*.3.3.1.2.

Exceptions:

1. The pile installation is completed by driving with an impact hammer in accordance with Section 1810*A*.3.3.1.1.
2. The pile is to be used only for lateral resistance.

The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensures element capacities equal or exceeding those of the test elements.

1810*A*.4.6 Heaved elements. Deep foundation elements that have heaved during the driving of adjacent elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the element shall be verified by load tests in accordance with Section 1810*A*.3.3.1.2.

1810*A*.4.7 Enlarged base cast-in-place elements. Enlarged bases for cast-in-place deep foundation elements formed by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. Such elements shall be constructed in the same manner as successful prototype test elements driven for the project. Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the shaft shall be filled sufficiently to reestablish lateral support by the soil. Where heave occurs, the element shall be replaced unless it is demonstrated that the element is undamaged and capable of carrying twice its design load.

1810*A*.4.8 Hollow-stem augered, cast-in-place elements. Where concrete or grout is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. As the auger is withdrawn at a steady rate or in increments not to exceed 1 foot (305 mm), concreting or grouting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete or grout volumes shall be measured to ensure that the volume of concrete or grout placed in each element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any element is interrupted or a loss of concreting or grouting pressure occurs, the element shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than 12 hours old, unless approved by the building official. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

1810*A*.4.9 Socketed drilled shafts. The rock socket and pipe or tube casing of socketed drilled shafts shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

1810*A*.4.10 Micropiles. Micropile deep foundation elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be

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pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a micropile or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means employed to ensure grout coverage outside the casing.

1810*A*.4.11 Helical piles. Helical piles shall be installed to specified embedment depth and torsional resistance criteria as determined by a registered design professional. The torque applied during installation shall not exceed the manufacturer's rated maximum installation torque resistance of the helical pile.

1810*A*.4.12 Special inspection. Special inspections in accordance with Sections 1705*A*.7 and 1705*A*.8 shall be provided for driven and cast-in-place deep foundation elements, respectively. Special inspections in accordance with Section 1705*A*.9 shall be provided for helical piles.

SECTION 1811A—PRESTRESSED ROCK AND SOIL FOUNDATION ANCHORS

1811A.1 General. *The requirements of this section address the use of vertical rock and soil anchors in resisting seismic or wind overturning forces resulting in tension on shallow foundations.*

1811A.2 Adoption. *Except for the modifications as set forth in Sections 1811A.3 and 1811A.4, all prestressed rock and soil foundation anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.*

1811A.3 Geotechnical requirements. *Geotechnical report for the prestressed rock and soil foundation anchors shall address the following:*

1. *Minimum diameter and minimum spacing for the anchors including consideration of group effects.*
2. *Maximum unbonded length and minimum bonded length of the tendon.*
3. *Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.*
4. *Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress.*
5. *Anchor axial tension stiffness recommendations at the anticipated anchor axial tension displacements, when required for structural analysis.*
6. *Minimum grout pressure for installation and post-grout pressure.*
7. *Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.*
8. *Performance test shall be at a minimum of 1.6 times the design loads, but shall not exceed 80 percent of the specified minimum tensile strength of the tendons. There shall be a minimum of two preproduction test anchors. Preproduction test anchors shall be tested to ultimate load or maximum of 0.80 times the specified minimum tensile strength of the tendon. A creep test is required for all prestressed anchors with greater than 10 kips of lock-off prestressing load.*
9. *Lock-off prestressing load requirements.*
10. *Acceptable drilling methods.*
11. *Geotechnical observation and monitoring requirements.*

1811A.4 Structural Requirements.

1. *Tendons shall be thread-bar anchors conforming to ASTM A722.*
2. *The anchors shall be placed vertical.*
3. *Design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.*
4. *Ultimate load shall be based upon Section 1617A.1.15 and shall not exceed 80 percent of the specified minimum tensile strength of the tendons.*
5. *The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge by group effect.*
6. *Foundation design shall incorporate the effect of lock-off loads.*
7. *Design shall account for as-built locations of soil anchors considering all the acceptable construction tolerances.*
8. *Design shall account for both short and long term deformation.*

9. *Enforcement agency may require consideration of anchor deformation in evaluating deformation compatibility or building drift where it may be significant.*

SECTION 1812A—EARTH RETAINING SHORING

1812A.1 General. *The requirements of this section shall apply to temporary and permanent earth retaining shoring using soldier piles and lagging with or without tie-back anchors in soil or rock, only when existing or new facilities are affected. Shoring used as construction means and methods only, which does not affect existing or new facilities, are not regulated by this section and shall satisfy the requirements of the authorities having jurisdiction.*

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1812A.2 through 1812A.8.

1812A.2 Duration. *Shoring shall be considered temporary when elements of the shoring will be exposed to site conditions for a period of less than or equal to 2 years, and shall be considered permanent otherwise. Permanent shoring shall account for the increase in lateral soil pressure due to earthquake. At the end of the construction period, the existing and new structures shall not rely on the temporary shoring for support in any way. Wood components shall not be used for permanent shoring lasting more than 2 years. Wood components of the temporary shoring that may affect the performance of permanent structure shall be removed after the shoring is no longer required.*

All components of the shoring shall have corrosion protection or preservative treatment for their expected duration. Wood components of the temporary shoring that will not be removed shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and compatible species in accordance with Section 5), and shall be identified in accordance with Section 2303.1.9.1.

1812A.3 Surcharge. *Surcharge pressure due to footings, traffic or other sources shall be considered in design. If the footing surcharge is located within the semicircular distribution or bulb of earth pressure (when shoring is located close to a footings), lagging shall be designed for lateral earth pressure due to footing surcharge. Soil arching effects may be considered in the design of lagging. Underpinning of the footing may be used in lieu of designing the shoring and lagging for surcharge pressure. Alternatively, continuously contacting drilled pier shafts near the footings shall be permitted. The lateral surcharge design pressure shall be derived using Boussinesq equations modified for the distribution of stresses in an elastic medium due to a uniform, concentrated or line surface load as appropriate and soil arching effects.*

1812A.4 Design and testing: *Except for the modifications as set forth in Sections 1812A.4.1 through 1812A.4.3, all Prestressed Rock and Soil Tie-back Anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.*

1812A.4.1 Geotechnical requirements: *The geotechnical report for the earth retaining shoring shall address the following:*

1. *Minimum diameter and minimum spacing for the anchors including consideration of group effects.*
2. *Maximum unbonded length and minimum bonded length of the tie-back anchors.*
3. *Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.*
4. *Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress for the anchor. For permanent anchors, a minimum factor of safety of 2.0 shall be applied to ground soil interface as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.6.*
5. *Minimum grout pressure for installation and post-grout pressure for the anchor. The presumptive post grout pressure of 300 psi may be used for all soil type.*
6. *Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.*
7. *Performance test for the anchors shall be at a minimum of two (2) times the design loads and shall not exceed 80 percent of the specified minimum tensile strength of the anchor rod. A creep test is required for all prestressed anchors that are performance tested. All production anchors shall be tested at 150 percent of design loads and shall not be greater than 70 percent of the specified minimum tensile strength of the anchor rod.*
8. *Earth pressure, surcharge pressure and the seismic increment of earth pressure loading, when applicable.*
9. *Maximum recommended lateral deformation at the top of the soldier pile, at the tie-back anchor locations and the drilled pier concrete shafts at the lowest grade level.*
10. *Allowable vertical soil bearing pressure friction resistance, and lateral passive soil resistance for the drilled pier concrete shafts and associated factors of safety for these allowable capacities.*
11. *Soil-pier shaft/pile interaction assumptions and lateral soil stiffness to be used in design for drilled pier concrete shaft or pile lateral loads.*
12. *Acceptable drilling methods.*
13. *Geotechnical observation and monitoring recommendations.*

1812A.4.2 Structural requirements*:*

1. *Tendons shall be thread-bar anchors conforming to ASTM A722.*
2. *Anchor design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.*
3. *The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge.*

4. *Design of shoring system shall account for as-built locations of soil anchors considering all specified construction tolerances in Section 1812A.8.*
5. *Design of shoring system shall account for both short and long-term deformation.*

***1812A.4.3 Testing of tie-back anchors**:*

1. *The geotechnical engineer shall keep a record at job site of all test loads, total anchor movement, and report their accuracy.*
2. *The shoring design engineer shall specify design loads for each anchor.*

***1812A.5 Construction.** The construction procedure shall address the following:*

1. *Holes drilled for piles/tie-back anchors shall be done without detrimental loss of ground, sloughing or caving of materials and without endangering previously installed shoring members or existing foundations.*
2. *Drilling of earth anchor shafts for tie-backs shall occur when the drill bench reaches two to three feet below the level of the tie-back pockets.*
3. *Casing or other methods shall be used where necessary to prevent loss of ground and collapse of the hole.*
4. *The drill cuttings from earth anchor shaft shall be removed prior to anchor installation.*
5. *Unless tremie methods are used, all water and loose materials shall be removed from the holes prior to installing piles/tie-backs.*
6. *Tie-back anchor rods with attached centralizing devices shall be installed into the shaft or through the drill casing. Centralizing device shall not restrict movement of the grout.*
7. *After lagging installation, voids between lagging and soil shall be backfilled immediately to the full height of lagging.*
8. *The soldier piles shall be placed within specified tolerances in the drilled hole and braced against displacement during grouting. Shafts shall be filled with concrete up to the elevation shown on the construction documents. The remainder of the shaft shall be permitted to be filled with controlled low-strength material (CLSM) when permitted by the construction documents. Excavation for lagging shall not be started until concrete has achieved sufficient strength for all anticipated loads as determined by the shoring design engineer.*
9. *Where boulders and/or cobbles have been identified in the geotechnical reports, contractor shall be prepared to address boulders and/or cobbles that may be encountered during the drilling of soldier piles and tie-back anchors.*
10. *The grouting equipment shall produce grout free of lumps and indispensed cement. The grouting equipment shall be sized to enable the grout to be pumped in continuous operation. The mixer shall be capable of continuously agitating the grout.*
11. *The quantity of grout and grout pressure shall be recorded. The grout pressure shall be controlled to prevent excessive heave in soils or fracturing rock formations.*
12. *If post-grouting is required, post-grouting operation shall be performed after initial grout has set for 24 hours in the bond length only. Tie-backs shall be grouted over a sufficient length (anchor bond length) to transfer the maximum anchor force to the anchor grout.*
13. *Testing of anchors in accordance with Section 1812A.4.1, Item 7 may be performed after post-grouting operations, provided grout has reached strength of 3,000 psi as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.11.*
14. *Anchor rods shall be tensioned straight and true. Excavation directly below the anchors shall not continue before those anchors are tested.*
15. *If a tie-back anchor initially fails the testing requirements, the anchor shall be permitted to be regrouted and retested. If anchor continues to fail, the followings steps shall be taken:*
    a. *The contractor shall determine the cause of failure—variations of the soil conditions, installation methods, materials, etc.*
    b. *The contractor shall propose a solution to remedy the problem. The proposed solution will need to be reviewed and approved by the geotechnical engineer, shoring design engineer and building official.*
16. *After a satisfactory test, each anchor shall be locked-off in accordance with Section 8.4 of PTI Recommendations for Prestressed Rock and Soil Anchors.*

1812A.6 Inspection, survey monitoring and observation.

1. *The shoring design engineer or his designee shall make periodic visits to the job site for the purpose of observing the installation of shoring system, testing of tie-back anchors and monitoring of survey.*
2. *Testing, inspection and observation shall be in accordance with testing, inspection and observation requirements approved by the building official. The following activities and materials shall be tested, inspected or observed by the special inspector and geotechnical engineer:*
    a. *Sampling and testing of concrete in soldier pile and tie-back anchor shafts.*
    b. *Fabrication of tie-back anchor pockets on soldier beams*
    c. *Installation and testing of tie-back anchors.*
    d. *Survey monitoring of soldier pile and tie-back load cells.*
    e. *Survey monitoring of existing buildings.*

3. *A complete and accurate record of all soldier pile locations, depths, concrete strengths, tie-back locations and lengths, tie-back grout strength, quantity of concrete per pile, quantity of grout per tie-back and applied tie-back loads shall be maintained by the special inspector and geotechnical engineer. The shoring design engineer shall be notified of any unusual conditions encountered during installation.*
4. *Calibration data for each test jack, pressure gauge and master pressure gauge shall be verified by the special inspector and geotechnical engineer. The calibration tests shall be performed by an independent testing laboratory and within 120 calendar days of the data submitted.*
5. *Monitoring points shall be established at the top and at the anchor heads of selected soldier piles and at intermediate intervals as considered appropriate by the geotechnical engineer.*
6. *Control points shall be established outside the area of influence of the shoring system to ensure the accuracy of the monitoring readings.*
7. *The periodic basis of shoring monitoring, as a minimum, shall be as follows:*
    a. *Initial monitoring shall be performed prior to any excavation.*
    b. *Once excavation has begun, the periodic readings shall be taken weekly until excavation reaches the estimated subgrade elevation and the permanent foundation is complete.*
    c. *If performance of the shoring is within established guidelines, shoring design engineer may permit the periodic readings to be bi-weekly. Once initiated, bi-weekly readings shall continue until the building slab at ground floor level is completed and capable of transmitting lateral loads to the permanent structure. Thereafter, readings can be monthly.*
    d. *Where the building has been designed to resist lateral earth pressures, the periodic monitoring of the soldier piles and adjacent structure can be discontinued once the ground floor diaphragm and subterranean portion of the structure is capable of resisting lateral soil loads and approved by the shoring design engineer, geotechnical engineer and building official.*
    e. *Additional readings shall be taken when requested by the special inspector, shoring design engineer, geotechnical engineer or building official.*
8. *Monitoring reading shall be submitted to the shoring design engineer, engineer in responsible charge and building official within three working days after they are conducted. Monitoring readings shall be accurate to within 0.01 feet. Results are to be submitted in tabular form showing at least the initial date of monitoring and reading, current monitoring date and reading and difference between the two readings.*
9. *If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $^1/_2$ inch or soldier piles reaches 1 inch all excavation activities shall be suspended. The geotechnical and shoring design engineer shall determine the cause of movement, if any, and recommend corrective measures, if necessary, before excavation continues.*
10. *If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $^3/_4$ inch or soldier piles reaches $1^1/_2$ inches all excavation activities shall be suspended until the causes, if any, can be determined. Supplemental shoring shall be devised to eliminate further movement and the building official shall review and approve the supplemental shoring before excavation continues.*
11. *Monitoring of tie-back anchor loads:*
    a. *Load cells shall be installed at the tie-back heads adjacent to buildings at maximum interval of 50 feet, with a minimum of one load cells per wall.*
    b. *Load cell readings shall be taken once a day during excavation and once a week during the remainder of construction.*
    c. *Load cell readings shall be submitted to the geotechnical engineer, shoring design engineer, engineer in responsible charge and building official.*
    d. *Load cell readings can be terminated once the temporary shoring no longer provides support for the buildings.*

1812A.7 Monitoring of existing structures.

1. *The contractor shall complete a written and photographic log of all existing structures within 100 ft or three times depth of shoring, prior to construction. A licensed surveyor shall document all existing substantial cracks in adjacent existing structures.*
2. *The contractor shall document existing condition of wall cracks adjacent to shoring walls prior to start of construction.*
3. *The contractor shall monitor existing walls for movement or cracking that may result from adjacent shoring.*
4. *If excessive movement or visible cracking occurs, the contractor shall stop work and shore/reinforce excavation and contact the shoring design engineer and building official.*
5. *Monitoring of the existing structure shall be at reasonable intervals as required by the registered design professional subject to approval of the building official. Monitoring shall be performed by a licensed surveyor and shall consist of vertical and lateral movement of the existing structures. Prior to starting shoring installation a preconstruction meeting shall take place between the contractor, shoring design engineer, surveyor, geotechnical engineer and building official to identify monitoring locations on existing buildings.*
6. *If in the opinion of the building official or shoring design engineer, monitoring data indicate excessive movement or other distress, all excavation shall cease until the geotechnical engineer and shoring design engineer investigate the situation and make recommendations for remediation or continuing.*
7. *All readings and measurements shall be submitted to the building official and shoring design engineer.*

1812A.8 Tolerances. *The following tolerances shall be specified on the construction documents.*

1. *Soldier piles:*
   a. *Horizontal and vertical construction tolerances for the soldier pile locations.*
   b. *Soldier pile plumbness requirements (angle with vertical line).*
2. *Tie-back anchors:*
   a. *Allowable deviation of anchor projected angle from specified vertical and horizontal design projected angle.*
   b. *Anchor clearance to the existing/new utilities and structures.*

SECTION 1813A—VIBRO STONE COLUMNS FOR GROUND IMPROVEMENT

1813A.1 General. *This section shall apply to vibro stone columns (VSCs) for ground improvement using unbounded aggregate materials. Vibro stone column provisions in this section are intended to increase bearing capacity, reduce settlements and mitigate liquefaction for shallow foundations. These requirements shall not be used for grouted or bonded stone columns, ground improvement for deep foundation elements or changing site class. VSCs shall not be considered a deep foundation element. Ground improvement shall be installed under the entire building/structure footprint and not under isolated foundation elements only. Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1813A.2 through 1813A.5.*

1813A.2 Geotechnical report. *The geotechnical report shall specify vibro stone column requirements to ensure uniformity in total and differential immediate settlement, long term settlement and earthquake induced settlement.*

1. *Soil compaction shall be in accordance with California Geological Survey (CGS) Special Publication 117A (SP-117A): Guidelines for Evaluating and Mitigating Seismic Hazard in California.*
2. *Area replacement ratio for the compaction elements and the basis of its determination shall be explained. Minimum factor of safety for soil compaction shall be in accordance with SP-117A.*
3. *Depth of soil compaction elements and extent beyond the footprint of structures/foundation shall be defined. Extent beyond the foundation shall be half the depth of the VSCs with a minimum of 10 ft or an approved alternative.*
4. *Minimum diameter and maximum spacing of soil compaction elements shall be specified. VSCs shall not be less than 2 feet in diameter, and center to center spacing shall not exceed 8 feet.*
5. *The modulus of subgrade reactions for shallow foundations shall account for the presence of compaction elements.*
6. *The modulus of subgrade reactions, long-term settlement and post-earthquake settlement shall be specified along with expected total and differential settlements for design.*
7. *The acceptance criteria for Friction Cone and Piezocone Penetration Testing in accordance with ASTM D5778 complemented by the standard penetration test (SPT) in accordance with ASTM D1586, if necessary, to verify soil improvement shall be specified.*
8. *The requirements for special inspection and observation by the geotechnical engineer shall be specified.*
9. *A final verified report (FVR) documenting the installation of the ground improvement system and confirming that the ground improvement acceptance criteria have been met shall be prepared by the geotechnical engineer and submitted to the enforcement agency for review and approval.*

1813A.3 Shallow foundations. *VSCs under the shallow foundation shall be located symmetrically around the centroid of the footing or load.*

1. *There shall be a minimum of four stone columns under each isolated or continuous/combined footing or approved equivalent.*
2. *The VSCs shall not be used to resist tension or overturning uplift from the shallow foundations.*
3. *The foundation design for the shallow foundation shall consider the increased vertical stiffness of the VSCs as point supports for analysis, unless it is substantiated that the installation of the VSCs result in improvement of the surrounding soils such that the modulus of subgrade reaction, long term settlement and post-earthquake settlement can be considered uniform throughout.*

1813A.4 Installation. *VSCs shall be installed with vibratory probes. Vertical columns of compacted unbounded aggregate shall be formed through the soils to be improved by adding gravel near the tip of the vibrator and progressively raising and repenetrating the vibrator which will results in the gravel being pushed into the surrounding soil. Gravel aggregate for VSCs shall be well graded with a maximum size of 6 inches and not more than 10 percent smaller than $^{3}/_{8}$ inch after compaction.*

1813A.5 Construction documents. *Construction documents for VSCs, as a minimum, shall include the following:*

1. *Size, depth and location of VSCs.*
2. *Extent of soil improvements along with building/structure foundation outlines.*
3. *Field verification requirements and acceptance criteria using CPT/SPT.*
4. *The locations where CPT/SPT shall be performed.*
5. *The testing, inspection and observation (TIO) program shall indicate the inspection and observation required for the VSCs.*
6. *A note indicating foundation construction shall not commence until the final verified report specified in Section 1813A.2 Item 9 has been submitted to and approved by the enforcement agency.*

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 19 – CONCRETE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	**X**				**X**								**X**			**X**								
Adopt entire chapter as amended (amended sections listed below)				**X**					**X**		**X**	**X**			**X**									
Adopt only those sections that are listed below																								
Chapter / Section																								
1901.1.1									X		X	X			X									
1901.1.2									X		X	X			X									
1901.1.3									X		X	X			X									
1901.1.4									X															
1901.1.5									X															
1901.3.1 – 1901.3.4.5											X	X			X									
1903.1											X	X			X									
1903.3											X	X			X									
1903.4											X	X			X									
1903.5											X	X			X									
1905.5											X	X			X									
1905.6											X	X			X									
1906											X	X			X									
1907.4.1				X																				
1908.1											X	X			X									
1909									X															
1910											X	X			X									
1911											X	X			X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

19 CONCRETE

About this chapter:	Chapter 19 provides minimum accepted practices for the design and construction of buildings and structural components using concrete—both plain and reinforced. Chapter 19 relies primarily on the reference to American Concrete Institute (ACI) 318, Building Code Requirements for Structural Concrete. Structural concrete must be designed and constructed to comply with this code and all listed standards. There are also specific provisions addressing slabs-on-ground and shotcrete. This chapter was extensively reorganized for the 2024 edition. For complete information, see the relocations table in the Preface information of this code.
ICC code development note:	Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 1901—GENERAL

1901.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

1901.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 19 is as follows:*

1. *Structures regulated by the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.*
2. *Structures regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD), which include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings listed in Sections 1.10.1, 1.10.2 and 1.10.5.*

1901.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] *DSA-SS/CC and OSHPD adopts this chapter as amended.*

1901.1.3 Identification of amendments. [DSA-SS/CC, OSHPD]

1. *Division of the State Architect - Structural Safety/Community Colleges amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS/CC] *– For applications listed in Section 1.9.2.2.*
2. ***[OSHPD 1R, 2 & 5]*** *Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [OSHPD 1R*] – For applications listed in Section 1.10.1.*

   [OSHPD 2] *– For applications listed in Section 1.10.2.*

   [OSHPD 5] *– For applications listed in Section 1.10.5.*

1901.1.4 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

1901.1.5 Additional amendments. [DSA-SS/CC] *See Section 1909 for additional requirements.*

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as supplemented in Section 1905 of this code.

1901.2.1 Structural concrete with GFRP reinforcement. Cast-in-place structural concrete internally reinforced with glass fiber reinforced polymer (GFRP) reinforcement conforming to ASTM D7957 and designed in accordance with ACI CODE 440.11 shall be permitted where fire-resistance ratings are not required and only for structures assigned to Seismic Design Category A.

1901.3 Anchoring to concrete. Anchoring to concrete shall be in accordance with ACI 318 as supplemented in Section 1905, and applies to cast-in (headed bolts, headed studs and hooked J- or L-bolts), post-installed expansion (torque-controlled and displacement-controlled), undercut, screw, and adhesive anchors.

1901.3.1 Power actuated fasteners. [OSHPD 1R, 2 & 5] *Power actuated fasteners qualified in accordance with ICC-ES AC 70 shall be deemed to satisfy the requirements of ASCE 7, Section 13.4.5.*

Power actuated fasteners shall be permitted in seismic shear for components exempt from construction documents review by ASCE 7, Section 13.1.4 and for interior non-bearing non-shear wall partitions only. Power actuated fastener shall not be used to anchor seismic bracing, exterior cladding or curtain wall systems.

Exception: *Power actuated fasteners in steel to steel connections prequalified for seismic application by cyclic tests in accordance with ICC-ES AC 70 shall be permitted for seismic design.*

1901.3.2 Mechanical anchors and specialty inserts. [OSHPD 1R, 2 & 5] *Mechanical anchors qualified in accordance with ICC-ES AC 193 shall be deemed to satisfy the requirements of this section. Specialty inserts, including cast-in-place specialty inserts, tested in accordance with ICC-ES AC 232 or AC 446 shall be deemed to satisfy the requirements of this section.*

Note: *The removal and resetting of post-installed mechanical anchors are prohibited by ACI 318 Section 17.1.3.*

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1901.3.3 Post-installed adhesive anchors. [OSHPD 1R, 2 & 5] *Post-installed reinforcing bars, adhesive anchors, and torque-controlled adhesive anchors qualified in accordance with ICC-ES AC 308 shall be deemed to satisfy the requirements of this section.*

1901.3.4 Proof tests for post-installed anchors in concrete. [OSHPD 1R, 2 & 5] *When post-installed anchors are used in lieu of cast-in place bolts, the proof test loads, frequency and acceptance criteria shall be in accordance with this section.*

Exceptions. *Proof tests are not required for the following:*

1. *Undercut anchors that allow visual confirmation of full set.*
2. *Repetitively installed anchors (with three or more identical anchors) of diameter one-quarter ($^1/_4$) inch or less used for distributed systems or architectural components.*
3. *Power actuated fasteners used to attach tracks of interior nonstructural partition walls resisting only shear loads and with at least three fasteners per segment of track.*
4. *Shear dowels across cold joints in slabs on grade, where the slab is not structural in accordance with Section 1907.1.*

> ***1901.3.4.1 General.*** *Test loads or torques, test frequencies, and acceptance criteria shall be shown on the construction documents.*

If any anchor fails testing, all anchors of the same type shall be tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

Anchors to be tested shall be selected at random by the special inspector or inspector of record (IOR) when 100 percent of the anchors are not tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

> ***1901.3.4.2 Proof testing procedure.*** *Post-installed anchors shall be tension tested in accordance with ASTM E3121 with test frequency and test loads in accordance with Sections 1901.3.4.3 and 1901.3.4.4, respectively. Proof tests using ASTM E3121 tension test procedure do not require displacement measurement.*

Exception: *Torque-controlled post-installed and screw-type anchors shall be permitted to be tested using torque based on a valid evaluation report using criteria adopted in this code.*

> ***1901.3.4.3 Test frequency.***

1901.3.4.3.1 Structural applications. *One hundred percent of post-installed anchors used for sructural applications shall be proof tested.*

Exceptions:

1. ***Sill bolts.*** *When post-installed anchors are used for sill plate or bottom track bolting applications, 10 percent of the anchors shall be tested.*
2. ***Rebar dowels.*** *When adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, 25 percent of dowels shall be tested if all the following conditions are met:*
   - 2.1. *The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.*
   - 2.2. *The number of dowels in any one member equals or exceeds twelve (12).*
   - 2.3. *The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).*

1901.3.4.3.2 Nonstructural applications. *Fifty percent of post-installed anchors used in nonstructural applications shall be proof tested. The percentage of tested anchors applies to each set of anchors of a common type (e.g., adhesive, wedge, or shell and sleeve for expansion bolts), size, and embedment depth and to each group of anchors. Four or more anchors connected to a common element shall be defined as a group.*

Exceptions:

1. ***Repetitive anchors.*** *When anchors are used repetitively (with three or more identical anchors) in distribution systems (such as pipe, duct or conduit supports) or architectural systems (such as suspended ceilings, cladding, and partitions), 20 percent of anchors, including at least one anchor in each group, shall be tested.*
2. ***Anchors with low tension.*** *When the design tension on anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents, 10 percent of anchors shall be tested.*

> ***1901.3.4.4 Test loads.*** *Required test loads shall be determined by one of the following methods:*

1. *Twice the maximum allowable tension load or one and a quarter ($1^1/_4$) times the maximum design strength of anchors as provided in approved evaluation report using criteria adopted in this code or determined in accordance with Chapter 17 of ACI 318.*

   Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ($= 0.8\, A_{se}\, f_{ya}$).
2. *The manufacturer's recommended installation torque based on approved evaluation report using criteria adopted in this code.*

> ***1901.3.4.5 Test acceptance criteria.*** *Proof test shall satisfy the following minimum requirements.*

1. ***Tension test:*** *Anchors shall be tested in the unconfined condition in accordance with ASTM E3121 except that the minimum clearance to the test frame shall be 1.5 times the anchor's embedment depth. Test load shall be maintained for a*

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minimum of 15 seconds and shall exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut or an abrupt decrease in the gauge pressure.

Exception: *Adhesive anchors shall be permitted to be tested in confined conditions in accordance with ASTM E3121 when the approved construction documents indicate that concrete breakout does not control the design tensile strength.*

2. ***Torque test:*** *Torque-controlled post-installed anchors tested with a calibrated torque wrench shall attain the specified torque within $^1/_2$ turn of the nut; or one-quarter ($^1/_4$) turn of the nut for a $^3/_8$-inch sleeve anchor only.*

   Screw-type anchors tested with a calibrated torque wrench shall attain the specified torque within one-quarter ($^1/_4$) turn of the screw after initial seating of the screw head.

1901.4 Composite structural steel and concrete structures. Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with Section 2202 of this code.

1901.5 Construction documents. The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. For structures assigned to Seismic Design Category D, E or F, a statement if slab on grade is designed as a structural diaphragm.

1901.6 Special inspections and tests. Special inspections and tests of concrete elements of buildings and structures and concreting operations shall be as required by Chapter 17.

1901.7 Tolerances for structural concrete. Where not indicated in construction documents, structural tolerances for concrete structural elements shall be in accordance with this section.

1901.7.1 Cast-in-place concrete tolerances. Structural tolerances for cast-in-place concrete structural elements shall be in accordance with ACI 117.

Exceptions:

1. Group R-3 detached one- or two-family dwellings are not required to comply with this section.
2. Shotcrete is not required to comply with this section.

1901.7.2 Precast concrete tolerances. Structural tolerances for precast concrete structural elements shall be in accordance with ACI ITG-7.

Exception: Group R-3 detached one- or two-family dwellings are not required to comply with this section.

SECTION 1902—COORDINATION OF TERMINOLOGY

1902.1 General. Coordination of terminology used in ACI 318 and ASCE 7 shall be in accordance with Section 1902.1.1.

1902.1.1 Design displacement. Design displacement shall be the Design Earthquake Displacement, δ_{DE}, defined in ASCE 7 Section 12.8.6.3. For diaphragms that can be idealized as rigid in accordance with ASCE 7 Section 12.3.1.2, δ_{di}, displacement due to diaphragm deformation corresponding to the design earthquake, is permitted to be taken as zero.

SECTION 1903—SPECIFICATIONS FOR TESTS AND MATERIALS

1903.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

Exception: *The following standards as referenced in Chapter 35 shall be permitted to be used.*

1. *ASTM C150*
2. *ASTM C595*
3. *ASTM C1157*

1903.2 Glass fiber-reinforced concrete. Glass fiber-reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI 128.

1903.3 Flat wall insulating concrete form (ICF) systems. *Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E2634.* ***[OSHPD 1R, 2 & 5]*** *Not Permitted by OSHPD.*

1903.4 Steel fiber reinforcement *-* ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

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***1903.5 Welding of reinforcing bars** - **[OSHPD 1R, 2 & 5]** Modify ACI 318 Section 26.6.4.1(b) by adding the following:*

Subject to prior approval of the enforcing agency, longitudinal holding wires conforming to ASTM A1064, of maximum wire size W5, that are machine resistance welded to stirrup/tie cage (or spiral assemblies) consisting of low alloy steel reinforcing conforming to ASTM A706 are permitted when performed under continuous competent control in a fabrication shop. Tack welding of primary reinforcing bars together or to stirrups/ties is not permitted. Holding wire weld locations shall not occur on any longitudinal or primary reinforcing nor on any portion of a reinforcing bar that is or will be bent in accordance with ACI 318 Section 25.3 for the extents specified in AWS D1.4 Section 4.2.6.

Quality control tests shall be performed on shop welded specimens by the fabricator. Reinforcing steel specimens containing the holding wire shall be tested for yield and tensile strength at the frequency required by Section 1910.2. Test reports shall be available on request to the approved agency, design professional and enforcement agency.

SECTION 1904—DURABILITY REQUIREMENTS

1904.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

Exception: For Group R-2 and R-3 occupancies not more than three stories above grade plane, the specified compressive strength, f'_c, for concrete in basement walls, foundation walls, exterior walls and other vertical surfaces exposed to the weather shall be not less than 3,000 psi (20.7 MPa).

1904.2 Nonstructural concrete. The registered design professional shall assign nonstructural concrete a freeze-thaw exposure class, as defined in ACI 318, based on the anticipated exposure of nonstructural concrete. Nonstructural concrete shall have a minimum specified compressive strength, f'_c, of 2,500 psi (17.2 MPa) for Class F0; 3,000 psi (20.7 MPa) for Class F1; and 3,500 psi (24.1 MPa) for Classes F2 and F3. Nonstructural concrete shall be air entrained in accordance with ACI 318.

SECTION 1905—SEISMIC REQUIREMENTS

1905.1 General. In addition to the provisions of ACI 318, structural concrete shall comply with the requirements of Section 1905.

1905.2 ACI 318 Section 2.3. Modify existing definitions and add the following definitions to ACI 318 Section 2.3:

CAST-IN-PLACE CONCRETE EQUIVALENT DIAPHRAGM. A cast-in-place noncomposite topping slab diaphragm, as defined in Section 18.12.5, or a diaphragm constructed with precast concrete components that uses closure strips between precast components with detailing that meets the requirements of ACI 318 for the Seismic Design Category of the structure.

DETAILED PLAIN CONCRETE STRUCTURAL WALL. A wall complying with the requirements of Chapter 14, and Section 1905.5 of the *California Building Code*.

ORDINARY PLAIN CONCRETE STRUCTURAL WALL. A wall complying with the requirements of Chapter 14, excluding 14.6.2.

ORDINARY PRECAST STRUCTURAL WALL. A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

ORDINARY REINFORCED CONCRETE STRUCTURAL WALL. A cast-in-place wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

PRECAST CONCRETE DIAPHRAGM. A diaphragm constructed with precast concrete components, with or without a cast-in-place topping, that includes the use of discrete connectors or joint reinforcement to transmit diaphragm forces.

1905.3 Intermediate precast structural walls. Intermediate precast structural walls shall comply with Section 18.5 of ACI 318 and this section.

1905.3.1 Connections designed to yield. Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the deformation induced by the design displacement or shall use Type 2 mechanical splices.

1905.4 Foundations designed to resist earthquake forces. Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and the ground shall comply with the requirements of Section 18.13 of ACI 318 and other applicable provisions of ACI 318 unless modified by Chapter 18.

1905.5 Detailed plain concrete structural walls. Detailed plain concrete structural walls are walls conforming to the requirements of ordinary plain concrete structural walls and Section 1905.5.1. ***[OSHPD 1R, 2 & 5]** Plain concrete shall not be permitted.*

1905.5.1 Reinforcement. Reinforcement shall be provided as follows:

1. Vertical reinforcement of not less than 0.20 square inch (129 mm^2) in cross-sectional area shall be provided continuously from support to support at each corner, at each side of each opening, and at the ends of walls. The continuous vertical bar required beside an opening is permitted to substitute for one of the two No. 5 bars required by Section 14.6.1 of ACI 318.
2. Horizontal reinforcement of not less than 0.20 square inch (129 mm^2) in cross-sectional area shall be provided:
   - 2.1. Continuously at structurally connected roof and floor levels and at the top of walls.
   - 2.2. At the bottom of load-bearing walls or in the top of foundations where doweled to the wall.
   - 2.3. At a maximum spacing of 120 inches (3048 mm).

Reinforcement at the top and bottom of openings, where used in determining the maximum spacing specified in Item 2.3, shall be continuous in the wall.

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1905.6 Structural plain concrete. Structural plain concrete elements shall comply with this section in lieu of Section 14.1.4 of ACI 318. ***[OSHPD 1R, 2 & 5]*** *Plain concrete shall not be permitted.*

1905.6.1 Seismic Design Categories A and B. In structures assigned to Seismic Design Category A or B, detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls are permitted to have plain concrete footings without longitudinal reinforcement.

1905.6.2 Seismic Design Categories C, D, E and F. Structures assigned to Seismic Design Category C, D, E or F shall not have elements of structural plain concrete, except as follows:

1. Structural plain concrete basement, foundation or other walls below the base as defined in ASCE/SEI 7 are permitted in detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls. In dwellings assigned to Seismic Design Category D or E, the height of the wall shall not exceed 8 feet (2438 mm), the thickness shall be not less than $7^{1}/_{2}$ inches (190 mm), and the wall shall retain not more than 4 feet (1219 mm) of unbalanced fill. Walls shall have reinforcement in accordance with Section 14.6.1 of ACI 318.
2. Isolated footings of plain concrete supporting pedestals or columns are permitted, provided that the projection of the footing beyond the face of the supported member does not exceed the footing thickness.

   Exception: In detached one- and two-family dwellings three stories or less in height, the projection of the footing beyond the face of the supported member is permitted to exceed the footing thickness.
3. Plain concrete footings supporting walls are permitted, provided that the footings have not fewer than two continuous longitudinal reinforcing bars. Bars shall not be smaller than No. 4 and shall have a total area of not less than 0.002 times the gross cross-sectional area of the footing. For footings that exceed 8 inches (203 mm) in thickness, not fewer than one bar shall be provided at the top and bottom of the footing. Continuity of reinforcement shall be provided at corners and intersections.

   Exceptions:

   1. Where assigned to Seismic Design Category C, detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls are permitted to have plain concrete footings without longitudinal reinforcement.
   2. For foundation systems consisting of a plain concrete footing and a plain concrete stemwall, not fewer than one bar shall be provided at the top of the stemwall and at the bottom of the footing.
   3. Footings cast monolithically with a slab-on-ground shall have not fewer than one No. 4 bar at the top and bottom of the footing or one No. 5 bar or two No. 4 bars in the middle third of the footing depth.

1905.7 Design requirements for anchors. For the design requirements for anchors, Sections 1905.7.1 and 1905.7.2 provide exceptions that are permitted to ACI 318.

1905.7.1 Anchors in tension. The following exception is permitted to ACI 318 Section 17.10.5.2:

Exception: Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE/SEI 7 Equation 12.11-1 or 12.14-10 shall be deemed to satisfy Section 17.10.5.3(d) of ACI 318.

1905.7.2 Anchors in shear. The following exceptions are permitted to ACI 318 Section 17.10.6.2:

Exceptions:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stemwalls, the in-plane shear strength in accordance with Sections 17.7.2 and 17.7.3 of ACI 318 need not be computed and Section 17.10.6.3 of ACI 318 shall be deemed to be satisfied provided that all of the following are met:
   1.1. The allowable in-plane shear strength of the anchor is determined in accordance with ANSI/AWC NDS Table 12E for lateral design values parallel to grain.
   1.2. The maximum anchor nominal diameter is $^{5}/_{8}$ inch (16 mm).
   1.3. Anchor bolts are embedded into concrete not less than 7 inches (178 mm).
   1.4. Anchor bolts are located not less than 1¾ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.
   1.5. Anchor bolts are located not less than 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.
   1.6. The sill plate is 2-inch (51 mm) or 3-inch (76 mm) nominal thickness.
2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stemwalls, the in-plane shear strength in accordance with Sections 17.7.2 and 17.7.3 of ACI 318 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided that all of the following are met:

   Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete, shall be permitted to be determined in accordance with AISI S100 Section J3.3.1.
   2.1. The maximum anchor nominal diameter is $^{5}/_{8}$ inch (16 mm).
   2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

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2.3. Anchors are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.

2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

2.5. The track is 33 to 68 mil (0.84 mm to 1.73 mm) designation thickness.

3. In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch (25 mm) in diameter attaching sill plate or track to foundation or foundation stemwalls need not satisfy Sections 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with Section 17.7.2.1(c) of ACI 318.

SECTION 1906—FOOTINGS FOR LIGHT-FRAME CONSTRUCTION

[OSHPD 1R, 2 & 5] *Plain concrete footings not permitted by OSHPD.*

1906.1 Plain concrete footings. For Group R-3 occupancies and buildings of other occupancies less than two stories above grade plane of light-frame construction, the required thickness of plain concrete footings is permitted to be 6 inches (152 mm), provided that the footing does not extend more than 4 inches (102 mm) on either side of the supported wall.

SECTION 1907—SLABS-ON-GROUND

1907.1 Structural slabs-on-ground. Structural concrete slabs-on-ground shall comply with all applicable provisions of this chapter. Slabs-on-ground shall be considered structural concrete where required by ACI 318 or where designed to transmit either of the following:

1. Vertical loads or lateral forces from other parts of the structure to the soil.
2. Vertical loads or lateral forces from other parts of the structure to foundations.

1907.2 Nonstructural slabs-on-ground. Nonstructural slabs-on-ground shall be required to comply with Sections 1904.2, 1907.3 and 1907.4. Portions of the nonstructural slabs-on-ground used to resist uplift forces or overturning shall be designed in accordance with accepted engineering practice throughout the entire portion designated as dead load to resist uplift forces or overturning.

1907.3 Thickness. The thickness of concrete floor slabs supported directly on the ground shall be not less than $3^1/_2$ inches (89 mm).

1907.4 Vapor retarder. A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where approved based on local site conditions.

1907.4.1 [HCD 1] Capillary break. *When a vapor retarder is required, a capillary break shall be installed in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

SECTION 1908—SHOTCRETE

1908.1 General. Shotcrete shall be in accordance with the requirements of ACI 318. ***[OSHPD 1R, 2 & 5]*** *and the provisions of ACI 506R.*

Preconstruction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705.3.9.

The evaluation of the shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 shall be in accordance with the requirements of ACI 506.4R with a core quality category of Very Good given in ACI 506.6T.

Shotcrete construction shall be in accordance with the requirements of ACI 506.2.

SECTION 1909—ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

1909.1 General.

1909.1.1 Construction documents. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

1909.2 Tests and materials. *Where required, special inspections and tests shall be in accordance with Chapter 17A and this section.*

1909.2.1 Steel fiber reinforcement *- Not permitted.*

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1909.2.2 Cementitious material. *The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for portland cement and ASTM C595 or ASTM C1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C618 or ASTM C989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used.*

1909.2.3 Tests of reinforcing bars. *Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.*

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each $2^{1}/_{2}$ tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings or non-building structures provided they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1909.2.4 Tests for prestressing steel and anchorage. *All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the job site. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.*

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or job site shall be furnished by the contractor and tested by an approved independent testing agency:

1. *For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.*
2. *For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.*

   Variations of the bearing plate size need not be considered.

   The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the prestressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

   Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.
3. *If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.*
4. *Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.*

1909.2.5 Composite construction cores. *Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).*

At least one core shall be taken from each building for each 5,000 square feet (465 m^2) of area of composite concrete construction and not less than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

1909.2.6 Proof tests for post-installed anchors in concrete. *When post-installed anchors are used in lieu of cast-in- place bolts, the proof test loads, frequency and acceptance criteria shall be in accordance with this section.*

Exceptions: *Proof tests are not required for the following:*

1. *Undercut anchors that allow visual confirmation of full set.*
2. *Repetitively installed anchors (with 3 or more identical anchors) of diameter one-quarter ($^{1}/_{4}$)-in. or less used for distributed systems or architectural components.*
3. *Power-actuated fasteners used to attach tracks of interior nonstructural partition walls, resisting only shear loads and with at least three anchors per segment of track.*
4. *Shear dowels across cold joints in slabs on grade, where the slab is not structural per Section 1907A.1.*

1909.2.6.1 General. *Test loads or torques, test frequencies and acceptance criteria shall be shown on the construction documents.*

If any anchor fails testing, all untested anchors of the same type and installed by the same trade shall be tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

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Anchors to be tested shall be selected at random by the special inspector or inspector of record (IOR), when 100 percent of the anchors are not tested. The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

> ***1909.2.6.2 Proof testing procedure.*** *Post-installed anchors shall be tension tested to verify proper installation in accordance with ASTM E3121 with test frequency and test loads in accordance with Sections 1909.2.6.3 and 1909.2.6.4, respectively. Tension tests do not require displacement measurement.*

Exception: *Torque-controlled post-installed anchors and screw type anchors shall be permitted to be tested using torque based on an approved evaluation report using criteria adopted in this code.*

>

1909.2.6.3 Test frequency.

1909.2.6.3.1 Structural applications. *100 percent of post-installed anchors used in structural applications shall be proof tested.*

Exceptions:

1. ***Sill bolts.*** *When post-installed anchors are used for sill plate or bottom track bolting applications, 10 percent of the anchors shall be tested.*
2. ***Rebar dowels.*** *When adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, 25 percent of the dowels shall be tested if all of the following conditions are met:*

> *2.1. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.*

2.2. The number of dowels in any one member equals or exceeds 12.

2.3. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

1909.2.6.3.2 Nonstructural applications. *50 percent of post-installed anchors used in nonstructural applications shall be proof tested. The percentage of tested anchors applies to each set of anchors of a common type (e.g., adhesive, wedge, or shell and sleeve for expansion bolts), size, and embedment depth and to each group of anchors. Four or more anchors connected to a common element shall be defined as a group.*

Exceptions:

1. ***Repetitive anchors.*** *When anchors are used repetitively (with 3 or more identical anchors) in distributed systems (such as pipe, duct or conduit supports) or architectural systems (such as suspended ceilings, cladding, and partitions), 20 percent of anchors, including at least one anchor in each group, shall be tested.*
2. ***Anchors with low tension.*** *When the design tension on anchors is less than 100 lbs and those anchors are clearly noted on the approved construction documents, 10 percent of anchors shall be tested.*

>

1909.2.6.4 Test loads. *Required test loads shall be determined by one of the following methods:*

1. *Twice the maximum allowable tension load or one and a quarter ($1^1/_4$) times the maximum design strength of anchors as provided in an approved test report using criteria adopted in this code or determined in accordance with Chapter 17 of ACI 318.*

   Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ($= 0.8 A_{se} f_{ya}$).
2. *The manufacturer's recommended installation torque based on an approved test report using criteria adopted in this code.*

> ***1909.2.6.5 Test acceptance criteria.*** *Proof tests shall satisfy the following minimum requirements.*

1. ***Tension test:*** *Anchors shall be tested in the unconfined condition in accordance with ASTM E3121 except that the minimum distance to the test frame shall be 1.5 times the anchor's embedment depth. Test load shall be maintained for a minimum of 15 seconds and shall exhibit no discernible movement during the tension test, e.g., as evidenced by loosening of the washer under the nut or an abrupt decrease in the gauge pressure.*

   Exception: *Adhesive anchors shall be permitted to be tested in confined conditions in accordance with ASTM E3121 when the approved construction documents shows that concrete breakout does not control the design tensile strength.*
2. ***Torque test:*** *Torque-controlled post-installed anchors tested with a calibrated torque wrench shall attain the specified torque within $^1/_2$ turn of the nut; or one-quarter ($^1/_4$) turn of the nut for a $^3/_8$-inch sleeve anchor only. Screw-type anchors tested with a calibrated torque wrench shall attain the specified torque within one-quarter ($^1/_4$) turn of the screw after initial seating of the screw head.*

1909.2.7 Flat wall insulating concrete form (ICF) systems. *ICF systems shall be considered alternative systems. Concrete constructed using ICF systems and attachments to ICF shall be designed for loads in accordance with this code and shall comply with manufacturer's instructions and industry standards determined applicable by the enforcement agency. Calculations and drawings shall be submitted to the enforcement agency for review and approval prior to construction.*

1909.3 Modifications to ACI 318.

1909.3.1 ACI 318, Section 11.9. *Modify ACI 318 by adding Section 11.9 as follows:*

11.9 - ***Foundation walls.*** *Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm)*

in height, intermediate horizontal reinforcing shall be provided at spacing not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of ACI 318 Section 11.6 and 11.7.

1909.3.2 ACI 318, Section 12.7.3. *Add Section 12.7.3.4 to ACI 318 as follows:*

12.7.3.4 – At least two No. 5 bars in diaphragms having two layers of reinforcement in both directions and one No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.

1909.3.3 ACI 318, Chapter 14. *Plain concrete is not permitted.*

1909.3.4 ACI 318, Section 18.10.6.5. *Modify ACI 318, Section 18.10.6.5 by adding the following:*

Where boundary members are not required by ACI 318 Section 18.10.6.2 or 18.10.6.3, minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per lineal foot of wall. Horizontal extent of boundary element shall be per ACI 318 Section 18.10.6.4 (a), (b) and (c).

1909.3.5 ACI 318, Section 18.12.6. *Add Section 18.12.6.2 to ACI 318 as follows:*

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or 6 d_b thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1909.3.6 ACI 318, Table 21.2.2. *Replace Table 21.2.2 as follows:*

TABLE 21.2.2 STRENGTH REDUCTION FACTOR ϕ FOR MOMENT, AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE

NET TENSILE STRAIN ε_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\varepsilon_t \le \varepsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\varepsilon_{ty} < \varepsilon_t < (\varepsilon_{ty} + 0.003)$	Transition[1,2]	$0.75 + 0.15\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(c)	$0.65 + 0.25\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(d)
$\varepsilon_t \ge (\varepsilon_{ty} + 0.003)$	Tension-controlled[3]	0.9	(e)	0.9	(f)

1. For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.
2. *ε_t^* is the greater of net tensile strain calculated for $P_n = 0.1A_g f_c'$ and $(\varepsilon_{ty} + 0.003)$.*
3. *For sections with factored axial compression force $P_u \ge 0.1A_g f_c'$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.*

1909.3.7 ACI 318, Section 25.2.10. *Modify ACI 318 Section 25.2.10 as follows:*

25.2.10 - For ties and hoops in columns to be placed with shotcrete, minimum clear spacing shall be 3 in. *Shotcrete shall not be applied to spirally tied columns.*

1909.3.8 ACI 318, Section 26.5.2. *Modify ACI 318 Section 26.5.2.1 by replacing Items (l), (m) and (n) and adding item (q) as follows:*

(l) Shotcrete surfaces intended to receive subsequent shotcrete placement *following an interruption of 30 minutes or more* shall be roughened to a full amplitude of approximately $^1/_4$ in. before the shotcrete has reached final set. *The film of laitance which forms on the surface of the shotcrete shall be removed within approximately 2 hours after application by brushing with a stiff broom. If this film is not removed within 2 hours, it shall be removed by thorough wire brushing or a mechanical method acceptable to the enforcement agency.*

(m) Before placing additional material onto hardened shotcrete, laitance shall be removed, joints shall be cleaned and the surface shall be dampened. *Construction joints over 8 hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.*

(n) In-place fresh concrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets, or other obvious defects shall be removed and replaced. *Shotcrete above sags and sloughs shall be removed and replaced while still plastic.*

(q) Surface preparation: Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by a mechanical method acceptable to the enforcement agency, and just prior to receiving shotcrete, shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be brought to a saturated surface-dry (SSD) before shotcrete is deposited.

1909.3.9 ACI 318, Section 26.11.1.2. *Modify ACI 318, Section 26.11.1.2 by adding Item (e) as follows:*

(e) Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound. Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

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1909.3.10 ACI 318, Section 26.12.2.1. *Modify ACI 318, Section 26.12.2.1 by replacing Item (a) as follows:*

(a) Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (38.2 m^3) of concrete, or not less than once for each 2,000 square feet (186 m^2) of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

1909.4 Shotcrete. *Shotcrete shall also conform to the provisions of ACI 506.2 and ACI 506R. The specified compressive strength of shotcrete shall not be less than 4,000 psi (27.6 MPa). Preconstruction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705A.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705A.3.9. The evaluation of the shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 shall be in accordance with the requirements of ACI 506.4R with a core quality category of Very Good given in ACI 506.6T. Tolerances for shotcrete construction shall be defined by the construction documents.*

1909.5 Existing concrete structures. *The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.*

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m^2) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed $^3/_4$ inch (19 mm).

SECTION 1910—ADDITIONAL REQUIREMENTS FOR SKILLED NURSING FACILITIES, INTERMEDIATE CARE FACILITIES, ACUTE PSYCHIATRIC AND NON-GAC BUILDINGS [OSHPD 1R, 2 & 5]

1910.1 General.

1910.1.1 Construction documents. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

1910.2 Tests and materials. *Where required, special inspections and tests shall be in accordance with Chapter 17 and this section.*

1910.2.1 Cementitious material. *The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for Portland cement and ASTM C595 or ASTM C1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C618 or ASTM C989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used.*

1910.2.2 Tests of reinforcing bars. *Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.*

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each $2^1/_2$ tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the building official for one-story buildings or nonbuilding structures, provided that they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1910.2.3 Tests for prestressing steel and anchorage*. All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the job site. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.*

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or job site shall be furnished by the contractor and tested by an approved independent testing agency:

1. *For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.*
2. *For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with the anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.*

   Variations of the bearing plate size need not be considered.

   The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the prestressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

   Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the

prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.

3. *If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.*
4. *Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.*

1910.2.4 Composite construction cores. *Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).*

At least one core shall be taken from each building for each 5,000 square feet (465 m^2) of area of composite concrete construction and not fewer than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

1910.3 Modifications to ACI 318.

1910.3.1 ACI 318, Section 12.7.3. *Add Section 12.7.3.4 to ACI 318 as follows:*

12.7.3.4 *– At least two No. 5 bars in diaphragms having two layers of reinforcement in both directions and one No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.*

1910.3.2 ACI 318, Section 18.12.6. *Add Section 18.12.6.2 to ACI 318 as follows:*

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or 6 d_b thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1910.3.3 ACI 318, Table 19.2.1.1. *Modify ACI 318 Table 19.2.1.1 as follows:*

For concrete designed and constructed in accordance with this chapter, f'_c, shall not be less than 3,000 psi (20.7 MPa). Reinforced normal weight concrete with specified compressive strength higher than 8,000 psi (55 MPa) shall require prior approval of structural design method and acceptance criteria by the enforcement agency.

1910.3.4 ACI 318, Section 26.11.1.2. *Modify ACI 318 Section 26.11.1.2 by adding Item (e) as follows:*

(e) Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound. Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

SECTION 1911—EXISTING CONCRETE STRUCTURES [OSHPD 1R, 2 & 5]

1911.1 Concrete Core Sampling. *Where concrete cores are required to be taken for material property determination, cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed $^3/_4$ inch (19 mm).*

1911.2 Crack repair by epoxy injection. *Crack Repair of concrete and masonry member by epoxy injection shall conform to all requirements of ACI 548.15.*

1911.3 Concrete strengthening by externally bonded fiber reinforced polymer (FRP). *Design and construction of externally bonded FRP systems for strengthening concrete structures shall be in accordance with ACI 440.2R.*

Exceptions:

1. *Near-Surface Mounted (NSM) FRP bars shall not be permitted.*
2. *Strengthening of shear walls and diaphragms (including chords and collectors) shall be considered as an alternative system.*

Design capacities, reliability and serviceability of FRP materials shall be permitted to be established in accordance with ICC-ES AC 125. Minimum inspection requirements of FRP composite systems shall be in accordance with ICC-ES AC 178.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 19A – CONCRETE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter								X		X				X										
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								
1905A.3 – 1905A3.1										†				†										

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

19*A* CONCRETE

User notes:

About this chapter: *Chapter 19A provides minimum accepted practices for the design and construction of buildings and structural components using reinforced concrete. Chapter 19A is applicable to structures regulated by the Division of the State Architect-Structural Safety—including public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Sections 1.9.2.1 [DSA-SS] and 1.9.2.2 [DSA-SS/CC])—and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development—including hospitals and correctional treatment centers (applications listed in Sections 1.10.1 [OSHPD 1] and 1.10.4 [OSHPD 4]).*

SECTION 1901*A*—GENERAL

1901*A*.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

1901A.1.1 Application. *The scope of application of Chapter 19A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Applications listed in Sections 1.10.1 and 1.10.4, regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD). These applications include hospitals and correctional treatment centers.*

1901A.1.2 Amendments in this chapter. *DSA-SS and OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:*

   [DSA-SS] *For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Hospital Planning and Development.*

   [OSHPD 1] *– For applications listed in Section 1.10.1.*

   [OSHPD 4] *– For applications listed in Section 1.10.4.*

1901*A*.2 *R*einforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as supplemented in Section 1905*A* of this code, *except that plain concrete is not permitted.*

1901*A*.3 Anchoring to concrete. Anchoring to concrete shall be in accordance with ACI 318 as supplemented in Section 1905*A*, and applies to cast-in (headed bolts, headed studs and hooked J- or L-bolts), post-installed expansion (torque-controlled and displacement-controlled), undercut, screw, and adhesive anchors.

1901*A*.4 Composite structural steel and concrete structures. Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with Section 2202*A* of this code.

1901*A*.5 Construction documents. The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. For structures assigned to Seismic Design Category D, E or F, a statement if slab on grade is designed as a structural diaphragm.
12. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

1901*A*.6 Special inspections and tests. *S*pecial inspections and tests of concrete elements of buildings and structures and concreting operations shall be as required by Chapter *17A and Section 1910A.*

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1901*A*.7 Tolerances for structural concrete. Where not indicated in construction documents, structural tolerances for concrete structural elements shall be in accordance with this section.

1901*A*.7.1 Cast-in-place concrete tolerances. Structural tolerances for cast-in-place concrete structural elements shall be in accordance with ACI 117.

Exceptions:

1. Group R-3 detached one- or two-family dwellings are not required to comply with this section.
2. Shotcrete is not required to comply with this section. ***[DSA-SS]*** *Tolerances for shotcrete construction shall be defined by the construction documents.*

1901*A*.7.2 Precast concrete tolerances. Structural tolerances for precast concrete structural elements shall be in accordance with ACI ITG-7.

Exception: Group R-3 detached one- or two-family dwellings are not required to comply with this section.

SECTION 1902*A*—COORDINATION OF TERMINOLOGY

1902*A*.1 General. Coordination of terminology used in ACI 318 and ASCE 7 shall be in accordance with Section 1902*A*.1.1.

1902*A*.1.1 Design displacement. Design displacement shall be the Design Earthquake Displacement, δ_{DE}, defined in ASCE 7 Section 12.8.6.3. For diaphragms that can be idealized as rigid in accordance with ASCE 7 Section 12.3.1.2, δ_{di}, displacement due to diaphragm deformation corresponding to the design earthquake, is permitted to be taken as zero.

SECTION 1903*A*—SPECIFICATIONS FOR TESTS AND MATERIALS

1903*A*.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

1903*A*.2 Glass fiber-reinforced concrete. Glass fiber-reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI 128.

1903*A*.3 Flat wall insulating concrete form (ICF) systems. Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E2634. ***[OSHPD 1 & 4]*** *Not permitted by OSHPD.* ***[DSA-SS]*** *ICF systems shall be considered alternative systems. Concrete constructed using ICF systems and attachments to ICF shall be designed for loads in accordance with this code and shall comply with manufacturer's instructions and industry standards determined applicable by the enforcement agency. Calculations and drawings shall be submitted to the enforcement agency for review and approval prior to construction.*

1903A.4 Steel fiber reinforcement *– Not permitted.*

1903A.5 Welding of reinforcing bars *- Modify ACI 318 Section 26.6.4.2(b) by adding the following:*

Subject to prior approval of the enforcing agency, longitudinal holding wires, conforming to ASTM A1064 of maximum wire size W5, that are machine resistance welded to stirrup/tie cage (or spiral assemblies) consisting of low alloy steel reinforcing conforming to ASTM A706 are permitted when performed under continuous competent control in a fabrication shop. Tack welding of primary reinforcing bars together or to stirrups/ties is not permitted. Holding wire weld locations shall not occur on any longitudinal or primary reinforcing nor on any portion of a reinforcing bar that is or will be bent in accordance with ACI 318 Section 25.3 for the extents specified in AWS D1.4 Section 4.2.6.

[DSA-SS] Exception: *Mat reinforcing for slabs or isolated footings shall be permitted to have holding wires located no more than six bar diameters from the free end of reinforcing. Such free ends shall not be associated with any welded splices, couplers or other free-end modifications involving reinforcement development.*

Quality control tests shall be performed on shop-welded specimens by the fabricator. Reinforcing steel specimens containing the holding wire shall be tested for yield and tensile strength at the frequency required by Section 1910A.2. Test reports shall be available on request to the approved agency, design professional and enforcement agency.

SECTION 1904*A*—DURABILITY REQUIREMENTS

1904*A*.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

1904*A*.2 Nonstructural concrete. The registered design professional shall assign nonstructural concrete a freeze-thaw exposure class, as defined in ACI 318, based on the anticipated exposure of nonstructural concrete. Nonstructural concrete shall have a minimum specified compressive strength, f'_c, of 2,500 psi (17.2 MPa) for Class F0; 3,000 psi (20.7 MPa) for Class F1; and 3,500 psi (24.1 MPa) for Classes F2 and F3. Nonstructural concrete shall be air entrained in accordance with ACI 318.

SECTION 1905*A*—SEISMIC REQUIREMENTS

1905*A*.1 General. In addition to the provisions of ACI 318, structural concrete shall comply with the requirements of Section 1905*A*.

1905*A*.2 ACI 318 Section 2.3. Modify existing definitions and add the following definitions to ACI 318 Section 2.3:

CAST-IN-PLACE CONCRETE EQUIVALENT DIAPHRAGM. A cast-in-place noncomposite topping slab diaphragm, as defined in Section 18.12.5, or a diaphragm constructed with precast concrete components that uses closure strips between precast components with detailing that meets the requirements of ACI 318 for the Seismic Design Category of the structure.

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PRECAST CONCRETE DIAPHRAGM. A diaphragm constructed with precast concrete components, with or without a cast-in-place topping, that includes the use of discrete connectors or joint reinforcement to transmit diaphragm forces.

1905*A*.3 Intermediate precast structural walls. ***[DSA-SS]*** Intermediate precast structural walls shall comply with Section 18.5 of ACI 318 and this section.

1905*A*.3.1 Connections designed to yield. Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the deformation induced by the design displacement or shall use Type 2 mechanical splices. *Connections between wall panels and the foundation shall be designed per Section 1617A.1.15.*

1905*A*.4 Foundations designed to resist earthquake forces. Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and the ground shall comply with the requirements of Section 18.13 of ACI 318 and other applicable provisions of ACI 318 unless modified by Chapter 18*A*.

1905*A*.5 Detailed plain concrete structural walls. *Not permitted.*

1905*A*.6 Structural plain concrete. *Not permitted.*

1905*A*.7 Design requirements for anchors. For the design requirements for anchors, Sections 1905*A*.7.1 and 1905*A*.7.2 provide exceptions that are permitted to ACI 318.

1905*A*.7.1 Anchors in tension. The following exception is permitted to ACI 318 Section 17.10.5.2:

Exception: Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE/SEI 7 Equation 12.11-1 *and Section 1604A.8.2 of this code* shall be deemed to satisfy Section 17.10.5.3(d) of ACI 318.

1905*A*.7.2 Anchors in shear. The following exceptions are permitted to ACI 318 Section 17.10.6.2:

Exceptions:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stemwalls, the in-plane shear strength in accordance with Sections 17.7.2 and 17.7.3 of ACI 318 need not be computed and Section 17.10.6.3 of ACI 318 shall be deemed to be satisfied provided that all of the following are met:
   1.1. The allowable in-plane shear strength of the anchor is determined in accordance with ANSI/AWC NDS Table 12E for lateral design values parallel to grain.
   1.2. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).
   1.3. Anchor bolts are embedded into concrete not less than 7 inches (178 mm).
   1.4. Anchor bolts are located not less than 1¾ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.
   1.5. Anchor bolts are located not less than 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.
   1.6. The sill plate is 2-inch (51 mm) or 3-inch (76 mm) nominal thickness.
2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stemwalls, the in-plane shear strength in accordance with Sections 17.7.2 and 17.7.3 of ACI 318 need not be computed and *Section* 17.10.6.3 shall be deemed to be satisfied provided that all of the following are met:

   Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete, shall be permitted to be determined in accordance with AISI S100 Section J3.3.1.
   2.1. The maximum anchor nominal diameter is $^5/_8$ inch (16 mm).
   2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).
   2.3. Anchors are located a minimum of $1^3/_4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.
   2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.
   2.5. The track is 33 to 68 mil (0.84 mm to 1.73 mm) designation thickness.
3. In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch (25 mm) in diameter attaching sill plate or track to foundation or foundation stemwalls need not satisfy Sections 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with Section 17.7.2.1(c) of ACI 318.

SECTION 1906*A*—*RESERVED*

SECTION 1907*A*—SLABS-ON-GROUND

1907*A*.1 Structural slabs-on-ground. Structural concrete slabs-on-ground shall comply with all applicable provisions of this chapter. Slabs-on-ground shall be considered structural concrete where required by ACI 318 or where designed to transmit either of the following:

1. Vertical loads or lateral forces from other parts of the structure to the soil.
2. Vertical loads or lateral forces from other parts of the structure to foundations.

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1907*A*.2 Nonstructural slabs-on-ground. Nonstructural slabs-on-ground shall be required to comply with Sections 1904*A*.2, 1907*A*.3 and 1907*A*.4. Portions of the nonstructural slabs-on-ground used to resist uplift forces or overturning shall be designed in accordance with accepted engineering practice throughout the entire portion designated as dead load to resist uplift forces or overturning.

1907*A*.3 Thickness. The thickness of concrete floor slabs supported directly on the ground shall be not less than $3^1/_2$ inches (89 mm).

1907*A*.4 Vapor retarder. A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where approved based on local site conditions.

SECTION 1908*A*—SHOTCRETE

1908*A*.1 General. Shotcrete shall be in accordance with the requirements of ACI 318 *and the provisions of ACI 506R. Preconstruction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705A.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705A.3.9. The evaluation of the shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 shall be in accordance with the requirements of ACI 506.4R with a core quality category of Very Good given in ACI 506.6T.*

Shotcrete construction shall be in accordance with the requirements of ACI 506.2.

SECTION 1909A—MODIFICATIONS TO ACI 318

1909A.1 General. *The text of ACI 318 shall be modified as indicated in Sections 1909A.1.1 through 1909A.1.16.*

1909A.1.1 ACI 318, Section 4.12.2.2. *Modify ACI 318, Section 4.12.2.2 by adding the following:*

Where prestressed concrete elements are restrained from movement, an analysis of the stresses in the prestressed elements and loads in the adjoining structural system induced by the above-described effects shall be made in accordance with PCI Design Handbook.

1909A.1.2 ACI 318, Section 4.12.2.3. *Modify ACI 318, Section 4.12.2.3 by adding the following:*

For prestressed concrete members with recessed or dapped ends, an analysis of the connections shall be made in accordance with procedures given in PCI Design Handbook.

1909A.1.3 ACI 318, Section 9.6.1.3. *Modify ACI 318, Section 9.6.1.3 by adding the following:*

This section shall not be used for members that resist seismic loads, except for either of the following conditions:

1. *Foundation members for one-story wood-frame or one-story light steel buildings.*
2. *Foundation members designed for seismic load combinations including the overstrength factor.* ***[OSHPD 1 & 4]*** *The A_s provided shall not be less than that required by 1.2 times the cracking load based upon f_r defined in Section 19.2.3.*

1909A.1.4 ACI 318, Section 11.2.4.1. *Replace ACI 318, Section 11.2.4.1 as follows:*

11.2.4.1 – Walls shall be anchored to intersecting elements such as floors or roofs; or to columns, pilasters, buttresses, of intersecting walls and footings with reinforcement at least equivalent to No. 4 bars at 12 inches (305 mm) on center for each layer of reinforcement.

1909A.1.5 ACI 318, Section 11.7. *Add Section 11.7.6 to ACI 318.1 as follows:*

11.7.6 – ***Reinforcement.*** *Perimeters of precast walls shall be reinforced continuously with a minimum of one No. 5 bar extending the full height and width of the wall panel. Where wall panels do not connect to columns or other wall panels to develop at least 75 percent of the horizontal wall steel as noted below, vertical perimeter bars shall be retained by hooked wall bars.*

A continuous tie or bond beam shall be provided at the roof line either as a part of the roof structure or part of the wall panels as described in the next paragraph below. This tie may be designed as the edge member of the roof diaphragm but, in any case, shall not be less than equivalent to two No. 6 bars continuous. A continuous tie equivalent to two No. 5 bars minimum shall also be provided either in the footing or with an enlarged section of the floor slab.

Wall panels of shear wall buildings shall be connected to columns or to each other in such a manner as to develop at least 75 percent of the horizontal wall steel. No more than half of this continuous horizontal reinforcing shall be concentrated in bond or tie beams at the top and bottom of the walls and at points of intermediate lateral support. If possible, cast-in-place joints with reinforcing bars extending from the panels into the joint a sufficient distance to meet the splice requirements of Section 25.5.2, for Class A shall be used. The reinforcing bars or welded tie details shall not be spaced over eight times the wall thickness vertically

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nor fewer than four used in the wall panel height. Where wall panels are designed for their respective overturning forces, the panel connections need not comply with the requirements of this paragraph.

Exception: *Nonbearing, nonshear panels such as nonstructural architectural cladding panels or column covers are not required to meet the provisions of this section.*

1909A.1.6 ACI 318, Section 11.9. *Modify ACI 318 by adding Section 11.9 as follows:*

11.9 – ***Foundation walls.*** *Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacing not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.*

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of Section 11.6 and 11.7.

1909A.1.7 ACI 318, Section 12.7.3. *Add Section 12.7.3.4 to ACI 318 as follows:*

12.7.3.4 – At least two No. 5 bars in diaphragms having two layers of reinforcement in either direction and one No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.

1909A.1.8 ACI 318, Section 18.10.6.5. *Modify ACI 318, Section 18.10.6.5 by adding the following:*

(c) Where boundary members are not required by Section 18.10.6.2 or 18.10.6.3 minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per lineal foot of wall. Horizontal extent of boundary element shall be in accordance with Section 18.10.6.4 (a), (b) and (c).

1909A.1.9 ACI 318, Section 18.12.6. *Add Section 18.12.6.2 to ACI 318 as follows:*

18.12.6.2 – Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or 6 d_b thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1909A.1.10 ACI 318, Section 19.2.1.1 and Table 19.2.1.1. *Modify ACI 318, Section 19.2.1.1 and Table 19.2.1.1 as follows:*

19.2.1.1 The value of f'_c shall be in be in accordance with (a) through *(e):*

(a) Limits for f'_c in Table 19.2.1.1. Limits apply to both normalweight and lightweight concrete.

(b) Durability requirements in Table 19.3.2.1.

(c) Structural strength requirements.

(d) f'_c for lightweight concrete in special moment frames and special structural walls, and their foundations, shall not exceed 5000 psi, unless demonstrated by experimental evidence that members made with lightweight concrete provide strength and toughness equal to or exceeding those of comparable members made with normalweight concrete of the same strength.

(e) Reinforced normal weight concrete with specified compressive strength higher than 8,000 psi (55 MPa) shall be considered as an alternative system.

***TABLE 19.2.1.1*—LIMITS FOR f_c'**

APPLICATION	MINIMUM f_c', psi
General	*3000*
Special moment frames Special structural walls with Grade 60 or 80 reinforcement	3000
Special structural walls with Grade 100 reinforcement	5000
Precast-nonprestressed driven piles Drilled shafts	4000
Precast-prestressed driven piles	5000
Shotcrete	*4000*

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1909A.1.11 ACI 318, Table 21.2.2.[DSA-SS] *Replace Table 21.2.2 as follows*:

TABLE 21.2.2—STRENGTH REDUCTION FACTOR ϕ FOR MOMENT, AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE

NET TENSILE STRAIN ε_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\varepsilon_t \le \varepsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\varepsilon_{ty} < \varepsilon_t < (\varepsilon_{ty} + 0.003)$	Transition[1,2]	$0.75 + 0.15\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(c)	$0.65 + 0.25\frac{\varepsilon_t - \varepsilon_{ty}}{\varepsilon_t^* - \varepsilon_{ty}}$	(d)
$\varepsilon_t \ge (\varepsilon_{ty} + 0.003)$	Tension-controlled[3]	0.9	(e)	0.9	(f)

1. For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.
2. *ε_t^* is the greater of net tensile strain calculated for $P_n = 0.1A_g f_c'$ and $(\varepsilon_{ty} + 0.003)$.*
3. *For sections with factored axial compression force $P_u \ge 0.1A_g f_c'$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.*

1909A.1.12 ACI 318, Section 24.2.1. *Add Section 24.2.1.1 to ACI 318 as follows:*

24.2.1.1 – Span to depth ratio. Prestressed beam and slab span to depth ratios for continuous prestressed concrete members shall not exceed the following, except when calculations of deflections and vibration effects prove that greater values may be used without adverse effects:

Beams..... 30

One-way slabs..... 40

Two-way floor slabs..... 40

Two-way roof slabs..... 44

These ratios should be decreased for special conditions such as heavy loads and simple spans.

Maximum deflection criteria shall be in accordance with ACI 318 Section 24.2.2.

1909A.1.13 ACI 318, Section 25.2.10. *Replace ACI 318 Section 25.2.10 by the following:*

25.2.10 – For ties and hoops in columns to be placed with shotcrete, minimum clear spacing shall be 3 in. *Shotcrete shall not be applied to spirally tied columns.*

1909A.1.14 ACI 318, Section 26.5.2. *Modify ACI 318 Section 26.5.2.1 by replacing items (l), (m) and (n) and adding item (q) as follows:*

(l) Shotcrete surfaces intended to receive subsequent shotcrete placement *following an interruption of 30 minutes or more* shall be roughened to a full amplitude of approximately $^1/_4$ in. before the shotcrete has reached final set. *The film of laitance which forms on the surface of the shotcrete shall be removed within approximately 2 hours after application by brushing with a stiff broom. If this film is not removed within 2 hours, it shall be removed by thorough wire brushing or a mechanical method acceptable to the enforcement agency.*

(m) Before placing additional material onto hardened shotcrete, laitance shall be removed, joints shall be cleaned, and the surface shall be dampened. *Construction joints over 8 hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.*

(n) In-place fresh concrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets, or other obvious defects shall be removed and replaced. *Shotcrete above sags and sloughs shall be removed and replaced while still plastic.*

(q) Surface preparation: Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by a mechanical method acceptable to the enforcement agency, and just prior to receiving shotcrete shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be brought to a saturated surface-dry (SSD) condition before shotcrete is deposited.

1909A.1.15 ACI 318, Section 26.11.1.2. *Modify ACI 318 Section 26.11.1.2 by adding item (e) as follows:*

(e) Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound. Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

1909A.1.16 ACI 318, Section 26.12.2.1(a). *Replace ACI 318 Section 26.12.2.1(a) by the following:*

26.12.2.1(a) – Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (345 m^3) of concrete, or not less than once for each 2,000 square feet (186 m^2) of surface area for slabs or walls. Additional samples for 7-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

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SECTION 1910A—CONCRETE, REINFORCEMENT AND ANCHOR TESTING

1910A.1 Cementitious material. *The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for portland cement and ASTM C595 or ASTM C1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C618 or ASTM C989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's Certificate of Compliance that represents the materials used by date of shipment for concrete. Cementitious materials without Certification of Compliance shall not be used.*

1910A.2 Tests of reinforcing bars. *Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.*

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2 $^1/_2$ tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings or non-building structures provided they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1910A.3 Tests for prestressing steel and anchorage*. All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the jobsite. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.*

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or jobsite shall be furnished by the contractor and tested by an approved independent testing agency:

1. *For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.*
2. *For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.*

   Variations of the bearing plate size need not be considered.

   The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the prestressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

   Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.
3. *If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.*
4. *Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.*

1910A.4 Composite construction cores. *Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).*

At least one core shall be taken from each building for each 5,000 square feet (465 m^2) of area of composite concrete construction and not less than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

1910A.5 Proof tests for post-installed anchors in concrete. *When post-installed anchors are used in lieu of cast-in place bolts, the proof test loads, frequency and acceptance criteria shall be in accordance with this section.*

Exceptions. *Proof tests are not required for the following:*

1. *Undercut anchors that allow visual confirmation of full set.*
2. *Repetitively installed anchors (with 3 or more identical anchors) of diameter one-quarter ($^1/_4$) in. or less used for distributed systems or architectural components.*
3. *Power actuated fasteners used to attach tracks of interior nonstructural partition walls resisting only shear loads and with at least three fasteners per segment of track.*
4. *Shear dowels across cold joints in slabs on grade where the slab is not structural in accordance with Section 1907A.1.*

1910A.5.1 General. *Test loads or torques, test frequencies, and acceptance criteria shall be shown on the construction documents.*

If any anchor fails testing, all untested anchors of the same type and installed by the same trade shall be tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

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Anchors to be tested shall be selected at random by the special inspector or inspector of record (IOR), when 100 percent of the anchors are not tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

1910A.5.2 Proof testing procedure. *Post-installed anchors shall be tension tested to verify proper installation in accordance with ASTM E3121 with test frequency and test loads in accordance with Sections 1910A.5.3 and 1910A.5.4, respectively. Tension tests do not require displacement measurement unless specified on the approved construction documents.*

Exception: *Torque-controlled post-installed anchors and screw-type anchors shall be permitted to be tested using torque based on a valid evaluation report and criteria adopted in this code.*

1910A.5.3 Test frequency.

1910A.5.3.1 Structural applications. *100 percent of post-installed anchors used for structural applications shall be proof tested.*

Exceptions:

1. ***Sill bolts.*** *When post-installed anchors are used for sill plate or bottom track bolting applications, 10 percent of the anchors shall be tested.*
2. ***Rebar dowels.*** *When adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, 25 percent of the dowels shall be tested if all of the following conditions are met:*
   - *2.1. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.*
   - *2.2. The number of dowels in any one member equals or exceeds 12.*
   - *2.3. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).*

1910A.5.3.2 Nonstructural applications. *50 percent of post-installed anchors used in nonstructural applications shall be proof tested. The percentage of tested anchors applies to each set of anchors of a common type (e.g., adhesive, wedge, or shell and sleeve for expansion bolts), size, and embedment depth and to each group of anchors. Four or more anchors connected to a common element shall be defined as a group.*

Exceptions:

1. ***Repetitive anchors.*** *When anchors are used repetitively (with 3 or more identical anchors) in distribution systems (such as pipe, duct or conduit supports) or architectural systems (such as suspended ceilings, cladding, and partitions), 20 percent of anchors, including at least one anchor in each group, shall be tested.*
2. ***Anchors with low tension.*** *When the design tension on anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents, 10 percent of anchors shall be tested.*
3. ***[OSHPD 4]*** *In state detention and correctional facilities, tension testing is not required for post-installed anchors used for attaching nonstructural components, such as grab bars and shower seats, to concrete walls if the components do not contribute to security/detainment, life safety and the continuous operation of the institution following an event of extreme environmental loading from flood, wind, snow or earthquakes, as determined by the enforcing agency.*

1910A.5.4 Test loads. *Required test loads shall be determined by one of the following methods:*

1. *Twice the maximum allowable tension load or one and a quarter ($1^1/_4$) times the maximum design strength of anchors as provided in an approved evaluation report using criteria adopted in this code or determined in accordance with Chapter 17 of ACI 318.*

   Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ($= 0.8\, A_{se}\, f_{ya}$).
2. *The manufacturer's recommended installation torque based on an approved evaluation report using criteria adopted in this code.*

1910A.5.5 Test acceptance criteria. *Proof tests shall satisfy the following minimum requirements.*

1. ***Tension test:*** *Anchors shall be tested in the unconfined condition in accordance with ASTM E3121 except that the minimum clearance to the test frame shall be 1.5 times the anchor's embedment depth. Test load shall be maintained for a minimum of 15 seconds and shall exhibit no discernible movement during the tension test, e.g., as evidenced by loosening of the washer under the nut or an abrupt decrease in the gauge pressure.*

   Exception: *Adhesive anchors shall be permitted to be tested in confined conditions in accordance with ASTM E3121 when the approved construction documents indicate that concrete breakout does not control the design tensile strength.*
2. ***Torque test:*** *Torque-controlled post-installed anchors tested with a calibrated torque wrench shall attain the specified torque within $^1/_2$ turn of the nut; or one-quarter ($^1/_4$) turn of the nut for a $^3/_8$ inch sleeve anchor only.*

   Screw-type anchors tested with a calibrated torque wrench shall attain the specified torque within one-quarter ($^1/_4$) turn of the screw after initial seating of the screw head.

SECTION 1911A—EXISTING CONCRETE STRUCTURES

1911A.1 Existing concrete structures.

The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.

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For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m^2) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed $^3/_4$ inch (19 mm).

1911A.2 Crack repair by epoxy injection. *Crack repair of concrete and masonry member by epoxy injection shall conform to all requirements of ACI 548.15.*

1911A.3 Concrete strengthening by externally bonded fiber reinforced polymer (FRP). *Design and construction of externally bonded FRP systems for strengthening concrete structures shall be in accordance with ACI 440.2R.*

Exceptions:

1. *Near-Surface Mounted (NSM) FRP bars shall not be permitted.*
2. *Strengthening of shear walls and diaphragms (including chords and collectors) shall be considered as an alternative system.*

*Design capacities, reliability, serviceability of FRP materials shall be permitted to be established in accorda*nce with ICC-ES AC 125. Minimum inspection requirements of FRP composite systems shall be in accordance with ICC-ES AC 178.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 20 – ALUMINUM

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X			X	X								X			X								
Adopt entire chapter as amended (amended sections listed below)								X	X	X	X	X		X	X									
Adopt only those sections that are listed below																								
Chapter / Section																								
2001.1.1								X	X	X	X	X		X	X									
2001.1.2								X	X	X	X	X		X	X									
2001.1.3								X	X	X	X	X		X	X									
2001.1.4											X			X										
2002.1								X	X	X	X	X		X	X									
2003								X	X	X	X	X		X	X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

20 ALUMINUM

User notes:

About this chapter: Chapter 20 contains standards for the use of aluminum in building construction. The use of aluminum in heating, ventilating or air-conditioning systems is addressed in the *California Mechanical Code*. This chapter references national standards from the Aluminum Association for use of aluminum in building construction, AA ASM 35, Aluminum Sheet Metal Work in Building Construction, and AA ADM, Aluminum Design Manual.

ICC code development note: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 2001—GENERAL

2001.1 Scope. This chapter shall govern the quality, design, fabrication and erection of aluminum.

2001.1.1 Application. [DSA-SS, DSA-SS/CC, OSHPD] *The scope of application of Chapter 20 is as follows:*

1. *Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.*
2. *Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1* ***[DSA-SS]*** *and 1.9.2.2* ***[DSA-SS/CC]****. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*

2001.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC, OSHPD] *DSA-SS, DSA-SS/CC and OSHPD adopt this chapter as amended.*

2001.1.3 Identification of amendments. [DSA-SS, DSA-SS/CC, OSHPD]

1. ***[OSHPD 1, 1R, 2, 4 & 5]*** *Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:*

   [OSHPD 1] *- For applications listed in Section 1.10.1.*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 4] *- For applications listed in Section 1.10.4.*

   [OSHPD 5] *- For applications listed in Section 1.10.5.*
2. ***[DSA-SS, DSA-SS/CC]*** *Division of the State Architect - Structural Safety amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS] *- For applications listed in Section 1.9.2.1.*

   [DSA-SS/CC] *- For applications listed in Section 1.9.2.2.*

2001.1.4 Reference to other chapters.

2001.1.4.1 [OSHPD 1 & 4] *Where reference within this chapter is made to sections in Chapters 16, 17, 18, 19, 21 and 22, the provisions in Chapters 16A, 17A, 18A, 19A, 21A and 22A, respectively, shall apply instead.*

SECTION 2002—MATERIALS

2002.1 General. Aluminum used for structural purposes in buildings and structures shall comply with AA ASM 35 and AA ADM. The nominal loads shall be the minimum design loads required by Chapter 16.

Exception: [DSA-SS] *The reference to Chapter 16 shall be to Chapter 16A.*

SECTION 2003—TESTING AND INSPECTION

2003.1 Testing and Inspection. [DSA-SS, DSA-SS/CC] *Testing and inspection of aluminum shall be required in accordance with the requirements for steel in Chapter 17A, except references to AWS D1.1 shall be to AWS D1.2.*

[OSHPD 1, 1R, 2, 4 & 5] *Testing and inspection of aluminum shall be required in accordance with the requirements for steel in Chapter 17, except references to AWS D1.1 shall be to AWS D1.2.*

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 21 – MASONRY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	**X**			**X**	**X**								**X**			**X**								
Adopt entire chapter as amended (amended sections listed below)									**X**		**X**	**X**			**X**									
Adopt only those sections that are listed below			**X**																		**X**			
Chapter / Section																								
2101.1.1									X		X	X			X									
2101.1.2									X		X	X			X									
2101.1.3									X		X	X			X									
2101.1.4									X															
2101.1.5									X															
2101.2											X	X			X									
2101.2.2											X	X			X									
2103.1											X	X			X									
2103.4											X	X			X									
2103.5											X	X			X									
2103.6											X	X			X									
2104.2											X	X			X									
2104.3											X	X			X									
2105.2											X	X			X									
2105.3											X	X			X									
2105.4											X	X			X									
2106.1.1											X	X			X									
2106.1.2											X	X			X									
2106.1.3											X	X			X									
2107.1											X	X			X									
2107.5											X	X			X									
2109											X	X			X									
2109.2.4.8.2																					X			
2110.1											X	X			X									
2113.9.2			X																					
2115									X															

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

21 MASONRY

User notes:

About this chapter: Chapter 21 establishes minimum requirements for masonry construction. The provisions address: material specifications and test methods; types of wall construction; criteria for engineered and empirical designs; and required details of construction, including the execution of construction. The provisions provide a framework for applying applicable standards to the design and construction of masonry structures. Masonry design methodologies including allowable stress design, strength design and empirical design are covered by the provisions of this chapter. Also addressed are masonry fireplaces and chimneys, masonry heaters and glass unit masonry.

ICC code development note: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 2101—GENERAL

2101.1 Scope. This chapter shall govern the materials, design, construction and quality of masonry.

2101.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 21 is as follows:*

1. *Structures regulated by the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC) which include those applications listed in Section 1.9.2.2.*
2. *Structures regulated by the Department of Health Care Access and Information/Office of Statewide Hospital planning and development (OSHPD), which include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings listed in Sections 1.10.1, 1.10.2 and 1.10.5.* <

2101.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] *DSA-SS/CC, OSHPD adopt this chapter as amended.*

2101.1.3 Identification of amendments. [DSA-SS/CC, OSHPD]

1. ***[DSA-SS/CC]*** *Division of the State Architect - Structural Safety/Community Colleges amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS/CC] *– For applications listed in Section 1.9.2.2.*
2. ***[OSHPD 1R, 2 & 5]*** *Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [OSHPD 1R*] - For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 5] *- For applications listed in Section 1.10.5.*

2101.1.4 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

2101.1.5 Additional amendments. [DSA-SS/CC] *See Section 2115 for additional requirements.*

2101.2 Design methods. Masonry shall comply with the provisions of TMS 402, TMS 403 or TMS 404 as well as applicable requirements of this chapter. ***[OSHPD 1R, 2 & 5]*** *TMS 403 Not permitted by OSHPD.*

2101.2.1 Masonry veneer. Masonry veneer shall comply with the provisions of Chapter 14.

2101.2.2 Prohibition. [OSHPD 1R, 2 & 5] *The following design methods, systems and materials in TMS402/602 are not permitted by OSHPD:*

1. *Unreinforced masonry.*
2. *Autoclaved Aerated Concrete (AAC) Masonry.*
3. *Empirical design of masonry.* <
4. *Adobe construction.*
5. *Ordinary reinforced masonry shear walls.*
6. *Intermediate reinforced masonry shear walls.*
7. *Prestressed masonry shear walls.*
8. *Direct design of masonry.*
9. *Design of masonry infill.*
10. *Prescriptive design of masonry partition walls.*
11. *Limit design method.*
12. *Glass fiber reinforced polymer (GFRP) reinforced masonry.*

2101.3 Special inspection. The special inspection of masonry shall be as defined in Chapter 17, or an itemized testing and inspection program shall be provided that meets or exceeds the requirements of Chapter 17.

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SECTION 2102—NOTATIONS

2102.1 General. The following notations are used in the chapter:

NOTATIONS.

d_b = Diameter of reinforcement, inches (mm).

F_s = Allowable tensile or compressive stress in reinforcement, psi (MPa).

f_r = Modulus of rupture, psi (MPa).

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

L_s = Distance between supports, inches (mm).

l_d = Required development length or lap length of reinforcement, inches (mm).

P = The applied load at failure, pounds (N).

S_t = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

S_w = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

SECTION 2103—MASONRY CONSTRUCTION MATERIALS

2103.1 Masonry units. Concrete masonry units, clay or shale masonry units, stone masonry units, glass unit masonry and AAC masonry units shall comply with Article 2.3 of TMS 602. Architectural cast stone shall conform to TMS 504. ***[OSHPD 1R, 2 & 5]*** *Architectural cast stone construction shall be considered as an alternative system.*

Exception: Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Table 705.5.

2103.1.1 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

2103.2 Mortar. Mortar for masonry construction shall comply with Section 2103.2.1, 2103.2.2, 2103.2.3 or 2103.2.4.

2103.2.1 Masonry mortar. Mortar for use in masonry construction shall conform to Articles 2.1 and 2.6 A of TMS 602.

2103.2.2 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

2103.2.3 Mortars for ceramic wall and floor tile. Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103.2.3.

TABLE 2103.2.3—CERAMIC TILE MORTAR COMPOSITIONS

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $^1/_5$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $^1/_2$ hydrated lime; 5 damp sand to 1 cement; 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $^1/_{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $^1/_2$ hydrated lime; $2^1/_2$ dry sand or 3 damp sand

2103.2.3.1 Dry-set Portland cement mortars. Premixed prepared Portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A108.5.

2103.2.3.2 Latex-modified Portland cement mortar. Latex-modified Portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified Portland cement shall be installed in accordance with ANSI A108.5.

2103.2.3.3 Epoxy mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2103.2.3.4 Furan mortar and grout. Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2103.2.3.5 Modified epoxy-emulsion mortar and grout. Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2103.2.3.6 Organic adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall be not less than 40 psi (275 kPa) for Type I adhesive and not

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less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2103.2.3.7 Portland cement grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

2103.2.4 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to Section 13.3 of TMS 402.

2103.3 Grout. Grout shall comply with Article 2.2 of TMS 602.

2103.4 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602. Where unidentified reinforcement ***[OSHPD 1R, 2 & 5]****, or bar reinforcement without mill certification,* is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work. ***[OSHPD 1R, 2 & 5]*** *Alternatively, the frequency of sampling for unidentifiable reinforcing bars specified in Section 1910.2 can be used.*

2103.5 Air entrainment. [OSHPD 1R, 2 & 5] *Air-entraining materials or air-entraining admixtures shall not be used in grout.*

2103.6 Specified compressive strength of masonry and grout. [OSHPD 1R, 2 & 5] *Replace TMS 402 Table 4.3.1 by the following:*

TABLE 4.3.1—SPECIFIED COMPRESSIVE STRENGTH REQUIREMENTS		
TYPE OF MASONRY	**SPECIFIED COMPRESSIVE STRENGTH OF MASONRY**	**SPECIFIED COMPRESSIVE STRENGTH OF GROUT**
Concrete masonry	*2,000 psi (13.79 MPa)* ≤ f'_m ≤ *3,000 psi (20.68 MPa)*	$f'_g \geq f'_m \leq$ 5,000 psi (34.47 MPa)
Clay masonry	*1,500 psi (10.34 MPa)* ≤ f'_m ≤ *4,500 psi (31.02 MPa)*	$f'_g \leq$ 6,000 (41.37 MPa)

SECTION 2104—CONSTRUCTION

2104.1 Masonry construction. Masonry construction shall comply with the requirements of Sections 2104.1.1 and 2104.1.2 and with the requirements of either TMS 602 or TMS 604.

2104.1.1 Support on wood. Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.13.

2104.1.2 Molded cornices. Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

2104.2 Reinforced Grouted masonry. [OSHPD 1R, 2 & 5]

2104.2.1 TMS 602, Article 3.3 B Placing mortar and units. *Modify TMS 602, Article 3.3 B.2.c as follows:*

c. Remove masonry protrusions extending *greater than* $^1/_4$ inch *(6.4 mm)* into cells or cavities to be grouted.

2104.2.2 TMS 602, Article 3.4 B Reinforcement. *Modify TMS 602, Article 3.4 B.1 through Article 3.4 B.3 as follows:*

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar. *Reinforcement and embedded items shall be clean, properly positioned and securely anchored against movement prior to grouting. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.*
2. Completely embed reinforcing bars and embedded items in grout in accordance with Article 3.5.
3. Maintain clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $^1/_2$ inch (12.7 mm) *and a minimum of one bar diameter,* except where cross webs of hollow units are used as supports for horizontal reinforcement.

2104.2.3 TMS 602, Article 3.4 E Anchor bolts. *Replace TMS 602, Article 3.4 E.3 and add Articles 3.4 E.5 and 3.4 E.6 as follows:*

3. *Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $^1/_2$ inch (12.7 mm) of grout between the bolt circumference, the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least $^1/_4$ inch (6.4 mm) when using fine grout and at least $^1/_2$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.*
5. *Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be $^1/_2$-inch (12.7 mm) diameter for 6-inch (152 mm) nominal masonry, $^3/_4$-inch (19.1 mm) diameter for 8-inch (203 mm) nominal masonry, $^7/_8$-inch (22.2 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25.4 mm) diameter for 12-inch (305 mm) nominal masonry.*
6. *Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.*

2104.2.4 TMS 602, Article 3.5 F.1 Grout key. *Replace TMS 602, Article 3.5 F.1 as follows:*

1. *Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of $1^1/_2$ inches (38.1 mm) and a maximum of one-half the masonry unit height below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of $^1/_2$*

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inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25.4 mm) above reinforcing steel for each grout pour.

2104.3 Aluminum equipment. [OSHPD 1R, 2 & 5] *Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.*

SECTION 2105—QUALITY ASSURANCE

2105.1 General. A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the approved construction documents.

The quality assurance program shall comply with the inspection and testing requirements of Chapter 17 and TMS 602.

> ***2105.2 Compressive strength, f'_m. [OSHPD 1R, 2 & 5]*** *Testing of masonry shall be provided in accordance with TMS 602, Article 1.4 B.*

Exception: *Where values of f'_m greater than 2,000 psi (13.79 MPa) are used in the design of reinforced grouted multi-wythe masonry and reinforced hollow unit masonry, they shall be based on prism test results in accordance with TMS 602, Article 1.4 B.3 submitted by the architect or engineer to the enforcement agency which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength exceed 3,000 psi (20.7 MPa).*

The architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract documents. Verification of compliance with the requirements for the specified strength of masonry during construction shall be provided using the prism test method in accordance with TMS 602, Article 1.4 B.3. Verification of compliance with the specified compressive strength prior to the start of construction shall be obtained by using the prism test method in accordance with TMS 602, Article 1.4 B.3.

2105.3 Mortar and grout tests. [OSHPD 1R, 2 & 5] TMS 602, Article 1.4 B Compressive strength determination. *Modify TMS 602, Article 1.4 B as follows by adding:*

5. Additional testing requirements:

a. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C1714 with a material certificate.

b. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet (464.5 m^2) of masonry wall area. They shall meet the minimum strength requirement given in ASTM C476/TMS 602 Section 2.2 or greater as specified.

c. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.

d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

Exception: *For nonbearing nonshear masonry walls not exceeding total wall height of 12 feet (3658 mm) above top of foundation, mortar test shall be permitted to be limited to those at the beginning of masonry work for each mix design.*

2105.4 Masonry core testing. [OSHPD 1R, 2 & 5] *Two cores shall be taken from each building for each 5,000 square feet (465 m^2) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.*

Core samples shall comply with the following:

1. *Cored no sooner than 7 days after grouting of the selected area;*
2. *Be a minimum of $3^3/_4$ inch (95.25 mm) nominal diameter; and*
3. *Sampled in such a manner as to exclude any masonry unit webs, mortar joint or reinforcing steel. If all cells contain reinforcement, alternate core locations or means to detect voids or delamination shall be selected by the registered design professional and approved by the building official.*

Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear tests of both joints between the grout core and the outside wythes or face shell of the masonry shall be made 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or nonabsorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of core shall not be less than 2.5 $\sqrt{f'_m}$ psi.

All cores shall be submitted to an approved agency for examination, including core specimens where a face shell separates from the grout core during the coring operation. The approved agency shall report the location where each core was taken, report the findings of their visual examination of each core, identify which cores were selected for shear testing, and report the results of the shear

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tests. Additional cores shall be permitted to be taken at the direction of the registered design professional and with approval of the enforcement agency.

Exceptions:

1. *Core sampling and testing is not required for non-bearing nonshear masonry walls, not exceeding total wall height of 12 feet above the top of the foundation, built with single-wythe hollow unit concrete masonry that attaches opposite face shells using webs cast as single unit, when designed using an f'_m not exceeding 2,000 psi (13.79MPa).*
2. *An infrared thermographic survey or other nondestructive test procedures shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in conjunction with reduced core sampling and testing. A minimum of two cores shall be taken from each building for each 10,000 square feet (930 m^2) of the wall.*

SECTION 2106—SEISMIC DESIGN

2106.1 Seismic design requirements for masonry. Masonry structures and components shall comply with the requirements in Chapter 7 of TMS 402 depending on the structure's seismic design category.

2106.1.1 TMS 402, Sections 5.4.1.4. [OSHPD 1R, 2 & 5] *Replace TMS 402, Section 5.4.1.4 Items (a), (b), (d) & (e) by the following:*

a. Vertical reinforcement shall be enclosed by lateral ties at least $^3/_8$ inch (*9.5 mm*) in diameter.
b. Vertical spacing of lateral ties, over the full height of the column, shall not exceed *8* longitudinal bar diameters, *24* lateral tie bar diameters, *8 inches (203 mm)*, *or one-half the* least cross-sectional dimension of the member.
d. Lateral ties shall be embedded in grout.
e. Lateral ties shall be located vertically not more than one-half lateral tie spacing above the top of the footing or slab in any story, and shall be spaced not more than one-half a lateral tie spacing nor 2 inches (51 mm) below the lowest horizontal reinforcement in beam, girder, slab, or drop panel above. *The top tie shall be within 2 inches (51 mm) of the top of the column.*

2106.1.2 TMS 402, Chapter 5. [OSHPD 1R, 2 & 5] *Add TMS 402, Section 5.7 as follows:*

5.7 – Lateral Support of Members

5.7.1 – Lateral support of masonry may be provided by cross walls, columns, pilasters, counterforts or buttresses where spanning horizontally, or by floors, beams, girts or roofs where spanning vertically. Where walls are supported laterally by vertical elements, the stiffness of each vertical element shall exceed that of the tributary area of the wall.

2106.1.3 TMS 402, Sections 7.4.4.1 and 7.4.5.1. [OSHPD 1R, 2 & 5] *Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:*

7.4.4.1 Minimum reinforcement requirements for masonry walls. *The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. Where other than running bond is used in reinforced hollow unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.*

All cells shall be solidly filled with grout.

Exception: *Reinforced hollow unit masonry used for freestanding site walls or interior nonbearing nonshear wall partitions shall have horizontal reinforcing spaced not more than 4 feet (1.2 m) on center, except for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement.*

7.4.4.1.1 *The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equally matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402 shall be considered as continuous reinforcement.*

7.4.4.1.2 *Horizontal reinforcing bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.*

7.4.4.1.3 *In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement required elsewhere.*

7.4.4.1.4 *When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.*

7.4.4.1.5 *Joint reinforcement shall not be used as principal reinforcement in masonry.*

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SECTION 2107—ALLOWABLE STRESS DESIGN

2107.1 General. The design of masonry structures using allowable stress design shall comply with Section 2106 and the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2107.2 through 2107.3 ***[OSHPD 1R, 2 & 5]*** *through 2107.5.*

2107.2 TMS 402, Section 6.1.7.1, lap splices. As an alternative to Section 6.1.7.1, it shall be permitted to design lap splices in accordance with Section 2107.2.1.

2107.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d, shall be:

Equation 21-1 $l_d = 0.002 d_b f_s$

For SI: $l_d = 0.29 d_b f_s$

but not less than 12 inches (305 mm). The length of the lapped splice shall be not less than 40 bar diameters.

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of F_s, the lap length of splices shall be increased not less than 50 percent of the minimum required length, but need not be greater than 72 d_b. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

2107.3 TMS 402, Section 6.1.7, splices of reinforcement. Add to Section 6.1.7 as follows:

6.1.7 – Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. Welding shall conform to AWS D1.4. Welded splices shall be of ASTM A706 steel reinforcement. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section 6.1.7.2.

2107.4 Reserved.

2107.5 [OSHPD 1R, 2 & 5] TMS 402, Section 8.3.4.4 Walls. *Modify TMS 402 by adding Section 8.3.4.4 as follows by adding:*

8.3.4.4.1 *The minimum thickness of walls is given in this section. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.*

8.3.4.4.2 *The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio or the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.*

8.3.4.4.3 *Every pier or wall section with a width less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section with a width between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.*

TABLE 8.3.4.4—MINIMUM THICKNESS OF MASONRY WALLS[1, 2]

TYPE OF MASONRY	*MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS[2,3]*	*NOMINAL MINIMUM THICKNESS (inches)*
BEARING OR SHEAR WALLS:		
1. Stone masonry	*14*	*16*
2. Reinforced grouted masonry	*25*	*6*
3. Reinforced hollow unit masonry	*25*	*6*
NONBEARING WALLS:		
4. Exterior reinforced walls	*30*	*6*
5. Interior partitions reinforced	*36*	*4*

1. *For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.*
2. *In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.*
3. *Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.*

SECTION 2108—STRENGTH DESIGN OF MASONRY

2108.1 General. The design of masonry structures using strength design shall comply with Section 2106 and the requirements of Chapters 1 through 7 and Chapter 9 of TMS 402, except as modified by Sections 2108.2 through 2108.3.

➡ **2108.2 TMS 402, Section 6.1.6, development.** Add a second paragraph to Section 6.1.6 as follows:

The required development length of reinforcement need not be greater than 72 d_b.

2108.3 TMS 402, Section 6.1.6.1.1, splices. Add to Sections 6.1.7.2.1 and 6.1.7.3.1 as follows:

6.1.7.3.1 – Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls.

6.1.7.2.1 – Mechanical splices shall be classified as Type 1 or 2 in accordance with Section 18.2.7.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special reinforced masonry shear walls. Type 2 mechanical splices are permitted in any location within a member.

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SECTION 2109—EMPIRICAL DESIGN OF ADOBE MASONRY

[OSHPD 1R, 2 & 5] *Not permitted by OSHPD.*

2109.1 General. Empirically designed adobe masonry shall conform to the requirements of Appendix A of TMS 402—16, except where otherwise noted in this section.

2109.1.1 Limitations. The use of empirical design of adobe masonry shall be limited as noted in Section A.1.2 of TMS 402—16. In buildings that exceed one or more of the limitations of Section A.1.2 of TMS 402—16, masonry shall be designed in accordance with the engineered design provisions of Section 2101.2 or the foundation wall provisions of Section 1807.1.5.

Section A.1.2.3 of TMS 402—16 shall be modified as follows:

A.1.2.3 – Wind. Empirical requirements shall not apply to the design or construction of masonry for buildings, parts of buildings, or other structures to be located in areas where V_{asd} as determined in accordance with Section 1609.3.1 of the *California Building Code* exceeds 110 mph.

2109.2 Adobe construction. Adobe construction shall comply with this section and shall be subject to the requirements of this code for Type V construction, Appendix A of TMS 402—16, and this section.

2109.2.1 Unstabilized adobe. Unstabilized adobe shall comply with Sections 2109.2.1.1 through 2109.2.1.4.

2109.2.1.1 Compressive strength. Adobe units shall have an average compressive strength of 300 psi (2068 kPa) when tested in accordance with ASTM C67. Five samples shall be tested and individual units are not permitted to have a compressive strength of less than 250 psi (1724 kPa).

2109.2.1.2 Modulus of rupture. Adobe units shall have an average modulus of rupture of 50 psi (345 kPa) when tested in accordance with the following procedure. Five samples shall be tested and individual units shall not have a modulus of rupture of less than 35 psi (241 kPa).

2109.2.1.2.1 Support conditions. A cured unit shall be simply supported by 2-inch-diameter (51 mm) cylindrical supports located 2 inches (51 mm) in from each end and extending the full width of the unit.

2109.2.1.2.2 Loading conditions. A 2-inch-diameter (51 mm) cylinder shall be placed at midspan parallel to the supports.

2109.2.1.2.3 Testing procedure. A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

2109.2.1.2.4 Modulus of rupture determination. The modulus of rupture shall be determined by the equation:

Equation 21-2 $$f_r = 3PL_s/[2S_w(S_t^2)]$$

2109.2.1.3 Moisture content requirements. Adobe units shall have a moisture content not exceeding 4 percent by weight.

2109.2.1.4 Shrinkage cracks. Adobe units shall not contain more than three shrinkage cracks and any single shrinkage crack shall not exceed 3 inches (76 mm) in length or $^1/_8$ inch (3.2 mm) in width.

2109.2.2 Stabilized adobe. Stabilized adobe shall comply with Section 2109.2.1 for unstabilized adobe in addition to Sections 2109.2.2.1 and 2109.2.2.2.

2109.2.2.1 Soil requirements. Soil used for stabilized adobe units shall be chemically compatible with the stabilizing material.

2109.2.2.2 Absorption requirements. A 4-inch (102 mm) cube, cut from a stabilized adobe unit dried to a constant weight in a ventilated oven at 212°F to 239°F (100°C to 115°C), shall not absorb more than $2^1/_2$ percent moisture by weight when placed on a constantly water-saturated, porous surface for seven days. Not fewer than five specimens shall be tested and each specimen shall be cut from a separate unit.

2109.2.3 Allowable stress. The allowable compressive stress based on gross cross-sectional area of adobe shall not exceed 30 psi (207 kPa).

2109.2.3.1 Bolts. Bolt values shall not exceed those set forth in Table 2109.2.3.1.

TABLE 2109.2.3.1—ALLOWABLE SHEAR ON BOLTS IN ADOBE MASONRY

DIAMETER OF BOLTS (inches)	MINIMUM EMBEDMENT (inches)	SHEAR (pounds)
$^1/_2$	—	—
$^5/_8$	12	200
$^3/_4$	15	300
$^7/_8$	18	400
1	21	500
$1^1/_8$	24	600

For SI: 1 inch = 25.4 mm, 1 pound = 4.448 N.

2109.2.4 Detailed requirements. Adobe construction shall comply with Sections 2109.2.4.1 through 2109.2.4.9.

2109.2.4.1 Number of stories. Adobe construction shall be limited to buildings not exceeding one story, except that two-story construction is allowed where designed by a registered design professional.

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2109.2.4.2 Mortar. Mortar for adobe construction shall comply with Sections 2109.2.4.2.1 and 2109.2.4.2.2.

2109.2.4.2.1 General. Mortar for adobe units shall be in accordance with Section 2103.2.1, or be composed of adobe soil of the same composition and stabilization as the adobe brick units. Unstabilized adobe soil mortar is permitted in conjunction with unstabilized adobe brick units.

2109.2.4.2.2 Mortar joints. Adobe units shall be laid with full head and bed joints and in full running bond.

2109.2.4.3 Parapet walls. Parapet walls constructed of adobe units shall be waterproofed.

2109.2.4.4 Wall thickness. The minimum thickness of exterior walls in one-story buildings shall be 10 inches (254 mm). The walls shall be laterally supported at intervals not exceeding 24 feet (7315 mm). The minimum thickness of interior load-bearing walls shall be 8 inches (203 mm). The unsupported height of any wall constructed of adobe units shall not exceed 10 times the thickness of such wall.

2109.2.4.5 Foundations. Foundations for adobe construction shall be in accordance with Sections 2109.2.4.5.1 and 2109.2.4.5.2.

2109.2.4.5.1 Foundation support. Walls and partitions constructed of adobe units shall be supported by foundations or footings that extend not less than 6 inches (152 mm) above adjacent ground surfaces and are constructed of solid masonry (excluding adobe) or concrete. Footings and foundations shall comply with Chapter 18.

2109.2.4.5.2 Lower course requirements. Stabilized adobe units shall be used in adobe walls for the first 4 inches (102 mm) above the finished first-floor elevation.

2109.2.4.6 Isolated piers or columns. Adobe units shall not be used for isolated piers or columns in a load-bearing capacity. Walls less than 24 inches (610 mm) in length shall be considered to be isolated piers or columns.

2109.2.4.7 Tie beams. Exterior walls and interior load-bearing walls constructed of adobe units shall have a continuous tie beam at the level of the floor or roof bearing and meeting the following requirements.

2109.2.4.7.1 Concrete tie beams. Concrete tie beams shall be 6 inches (152 mm) or more in depth and 10 inches (254 mm) or more in width. Concrete tie beams shall be continuously reinforced with not fewer than two No. 4 reinforcing bars. The specified compressive strength of concrete shall be not less than 2,500 psi (17.2 MPa).

2109.2.4.7.2 Wood tie beams. Wood tie beams shall be solid or built up of lumber having a nominal thickness of not less than 1 inch (25 mm), and shall have a depth of not less than 6 inches (152 mm) and a width of not less than 10 inches (254 mm). Joints in wood tie beams shall be spliced not less than 6 inches (152 mm). Splices shall not be allowed within 12 inches (305 mm) of an opening. Wood used in tie beams shall be approved naturally decay-resistant or preservative-treated wood.

2109.2.4.8 Exterior finish. Exterior finishes applied to adobe masonry walls shall be of any type permitted by this section or Chapter 14, except where stated otherwise in this section.

2109.2.4.8.1 Where required. Unstabilized adobe masonry walls shall receive a weather protective exterior finish in accordance with Section 2109.2.4.8.

2109.2.4.8.2 Vapor permeance. Plaster and finish assemblies shall have a vapor permeance of not less than 5 perms.

Exception: Insulation products applied to the exterior of stabilized adobe masonry walls in Climate Zones 2B, 3B, 4B and 5B shall not have a vapor permeance requirement. *Comparison of IECC and California Energy Code climate zones is shown in Chapter 12, Table 1202.3.1.*

2109.2.4.8.3 Plaster thickness and coats. Plaster applied to adobe masonry shall be not less than $^{7}/_{8}$ inch (22 mm) and not greater than 2 inches (51 mm) thick. Plaster shall be applied in not less than two coats.

2109.2.4.8.4 Plaster application. Where plaster is applied directly to adobe masonry walls, no intermediate membrane shall be used.

2109.2.4.8.5 Lath for plaster. Lath shall be provided for all plasters, except where not required elsewhere in Section 2109.2.4.8. Fasteners shall be corrosion resistant and spaced at a maximum of 16 inches (406 mm) on center with a minimum $1^{1}/_{2}$-inch (38 mm) penetration into the adobe wall. Metal lath shall comply with ASTM C1063, as modified by this section, and shall be corrosion resistant. Plastic lath shall comply with ASTM C1788, as modified by this section. Wood substrates shall be protected with No. 15 asphalt felt, an approved wood preservative or other protective coating prior to lath application.

2109.2.4.8.6 Cement plaster. Cement plaster shall conform to ASTM C926 and shall comply with Chapter 25, except that the proportion of lime in plaster coats shall be not less than 1 part lime to 4 parts cement. The combined thickness of cement plaster coats shall not exceed 1 inch (25 mm).

2109.2.4.8.7 Lime plaster. Lime plaster is any plaster with a binder composed of calcium hydroxide, including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime, or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.

2109.2.4.8.8 Cement-lime plaster. Cement-lime plaster shall be any plaster mix type CL, F or FL, as described in ASTM C926.

2109.2.4.8.9 Clay plaster. Clay plaster shall comply with this section.

2109.2.4.8.9.1 General. Clay plaster shall be any plaster having a clay or clay subsoil binder. Such plaster shall contain sufficient clay to fully bind the aggregate and shall be permitted to contain reinforcing fibers. Acceptable reinforcing fibers include chopped straw, sisal, and animal hair.

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2109.2.4.8.9.2 Clay subsoil requirements. The suitability of clay subsoil shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.

2109.2.4.8.9.3 Weather-exposed locations. Clay plaster exposed to water from direct or wind-driven rain or snow shall be finished with an approved erosion-resistant finish. The use of clay plasters shall not be permitted on weather-exposed parapets.

2109.2.4.8.9.4 Prohibited finish coat. Plaster containing Portland cement shall not be permitted as a finish over clay plaster.

2109.2.4.8.9.5 Conditions where lathing is not required. For unstabilized adobe walls finished with unstabilized clay plaster, lathing shall not be required.

2109.2.4.9 Lintels. Lintels shall be considered to be structural members and shall be designed in accordance with the applicable provisions of Chapter 16.

SECTION 2110—GLASS UNIT MASONRY

2110.1 General. ***[OSHPD 1R, 2 & 5]*** *Masonry glass block walls or panels shall be designed for seismic forces. Stresses in glass block shall not be utilized.* Glass unit masonry construction shall comply with Chapter 14 of TMS 402 and this section.

2110.1.1 Limitations. Solid or hollow approved glass block shall not be used in fire walls, party walls, fire barriers, fire partitions or smoke barriers, or for load-bearing construction. Such blocks shall be erected with mortar and reinforcement in metal channel-type frames, structural frames, masonry or concrete recesses, embedded panel anchors as provided for both exterior and interior walls or other approved joint materials. Wood strip framing shall not be used in walls required to have a fire-resistance rating by other provisions of this code.

Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than $^{3}/_{4}$ hour shall be permitted as opening protectives in accordance with Section 716 in fire barriers, fire partitions and smoke barriers that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways and ramps or exit passageways.
2. Glass-block assemblies as permitted in Section 404.6, Exception 2.

SECTION 2111—MASONRY FIREPLACES

2111.1 General. The construction of masonry fireplaces, consisting of concrete or masonry, shall be in accordance with this section.

2111.2 Fireplace drawings. The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be indicated.

2111.3 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (153 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2111.3.1 Ash dump cleanout. Cleanout openings, located within foundation walls below fireboxes, where provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

2111.4 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry fireplaces shall be reinforced and anchored in accordance with Sections 2111.4.1, 2111.4.2 and 2111.5. In structures assigned to Seismic Design Category E or F, masonry fireplaces shall be reinforced in accordance with the requirements of Sections 2101 through 2108.

2111.4.1 Vertical reinforcing. For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103.3. For fireplaces with chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2111.4.2 Horizontal reinforcing. Vertical reinforcement shall be placed enclosed within $^{1}/_{4}$-inch (6.4 mm) ties or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete; or placed in the bed joints of unit masonry at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2111.5 Seismic anchorage. Masonry fireplaces and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two $^{3}/_{16}$-inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not fewer than four floor joists with two $^{1}/_{2}$-inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

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2111.6 Firebox walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Where a lining of firebrick not less than 2 inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and sidewalls shall each be 8 inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall be not greater than $^1/_4$ inch (6.4 mm). Where a lining is not provided, the total minimum thickness of back and sidewalls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C27 or ASTM C1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C199.

2111.6.1 Steel fireplace units. Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace provided that they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than $^1/_4$ inch (6.4 mm) in thickness, and an air-circulating chamber that is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

2111.7 Firebox dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall be not less than 8 inches (203 mm) above the fireplace opening. The throat opening shall be not less than 4 inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall be not less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is not less than 12 inches (305 mm) and not less than one-third of the width of the fireplace opening, and the throat is not less than 12 inches (305 mm) above the lintel, and not less than $^1/_{20}$ the cross-sectional area of the fireplace opening.

2111.8 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located not less than 8 inches (203 mm) above the top of the fireplace opening.

2111.8.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located not less than 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

2111.9 Smoke chamber walls. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. The total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of solid masonry. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C199. Where a lining of firebrick not less than 2 inches (51 mm) thick, or a lining of vitrified clay not less than $^5/_8$ inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C1261 and shall be laid with refractory mortar conforming to ASTM C199. Vitrified clay linings shall conform to ASTM C315.

2111.9.1 Smoke chamber dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall be not greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical where prefabricated smoke chamber linings are used or where the smoke chamber walls are rolled or sloped rather than corbeled. Where the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

2111.10 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. Combustible material shall not remain against the underside of hearths or hearth extensions after construction.

2111.10.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

2111.10.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: Where the bottom of the firebox opening is raised not less than 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than $^3/_8$-inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

2111.11 Hearth extension dimensions. Hearth extensions shall extend not less than 16 inches (406 mm) in front of, and not less than 8 inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557 m^2) or larger, the hearth extension shall extend not less than 20 inches (508 mm) in front of, and not less than 12 inches (305 mm) beyond, each side of the fireplace opening.

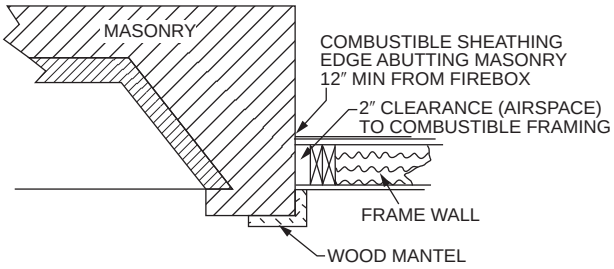
2111.12 Fireplace clearance. Any portion of a masonry fireplace located in the interior of a building or within the exterior wall of a building shall have a clearance to combustibles of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section 2111.13.

Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's instructions are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.

3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and drywall, are permitted to abut the masonry fireplace sidewalls and hearth extension, in accordance with Figure 2111.12, provided that such combustible trim or sheathing is not less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening, provided that such combustible materials shall not be placed within 6 inches (153 mm) of a fireplace opening. Combustible material directly above and within 12 inches (305 mm) of the fireplace opening shall not project more than $^1/_8$ inch (3.2 mm) for each 1-inch (25 mm) distance from such opening. Combustible materials located along the sides of the fireplace opening that project more than $1^1/_2$ inches (38 mm) from the face of the fireplace shall have an additional clearance equal to the projection.

FIGURE 2111.12—ILLUSTRATION OF EXCEPTION TO FIREPLACE CLEARANCE PROVISION



For SI: 1 inch = 25.4 mm

2111.13 Fireplace fireblocking. All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

2111.14 Exterior air. Factory-built or masonry fireplaces covered in this section shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

2111.14.1 Factory-built fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be listed components of the fireplace, and installed according to the fireplace manufacturer's instructions.

2111.14.2 Masonry fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

2111.14.3 Exterior air intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within a garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of $^1/_4$-inch (6.4 mm) mesh.

2111.14.4 Clearance. Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

2111.14.5 Passageway. The combustion air passageway shall be not less than 6 square inches (3870 mm^2) and not more than 55 square inches (0.035 m^2), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer's instructions.

2111.14.6 Outlet. The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

SECTION 2112—MASONRY HEATERS

2112.1 Definition. A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as "masonry," which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes flow in either a horizontal or downward direction before entering the chimney and which delivers heat by radiation from the masonry surface of the heater.

2112.2 Installation. Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E1602.
2. Masonry heaters shall be listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer's instructions.

2112.3 Footings and foundation. The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section 2113.2.

2112.4 Seismic reinforcing. In structures assigned to Seismic Design Category D, E or F, masonry heaters shall be anchored to the masonry foundation in accordance with Section 2113.3. Seismic reinforcing shall not be required within the body of a masonry heater with a height that is equal to or less than 3.5 times its body width and where the masonry chimney serving the heater is not

supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with Section 2113.

2112.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (914 mm) or the distance of the allowed reduction method from the outside surface of a masonry heater in accordance with NFPA 211, Section 12.6, and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. Where the masonry heater wall thickness is not less than 8 inches (203 mm) of solid masonry and the wall thickness of the heat exchange channels is not less than 5 inches (127 mm) of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of not less than 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer's instructions.

SECTION 2113—MASONRY CHIMNEYS

2113.1 General. The construction of masonry chimneys consisting of solid masonry units, hollow masonry units grouted solid, stone or concrete shall be in accordance with this section.

2113.2 Footings and foundations. Footings for masonry chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2113.3 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry chimneys shall be reinforced and anchored in accordance with Sections 2113.3.1, 2113.3.2 and 2113.4. In structures assigned to Seismic Design Category E or F, masonry chimneys shall be reinforced in accordance with the requirements of Sections 2101 through 2108 and anchored in accordance with Section 2113.4.

2113.3.1 Vertical reinforcement. For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars anchored in the foundation shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103.3. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2113.3.2 Horizontal reinforcement. Vertical reinforcement shall be placed enclosed within $^{1}/_{4}$-inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete, or placed in the bed joints of unit masonry, at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2113.4 Seismic anchorage. Masonry chimneys and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two $^{3}/_{16}$-inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not less than four floor joists with two $^{1}/_{2}$-inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

2113.5 Corbeling. Masonry chimneys shall not be corbeled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

2113.6 Changes in dimension. The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

2113.7 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section 2113.5.

2113.8 Additional load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building.

2113.9 Termination. Chimneys shall extend not less than 2 feet (610 mm) higher than any portion of the building within 10 feet (3048 mm), but shall be not less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

2113.9.1 Chimney caps. Masonry chimneys shall have a concrete, metal or stone cap, sloped to shed water, a drip edge and a caulked bond break around any flue liners in accordance with ASTM C1283.

2113.9.2 Spark arrestors. ***[SFM]*** *All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester.* The spark arrestor shall meet all of the following requirements:

1. *The net free area of the spark arrestor shall not be less than four times the net free area of the outlet of the chimney.*
2. *The spark arrestor screen shall have heat and corrosion resistance equivalent to 12-gage wire, 19-gage galvanized steel or 24-gage stainless steel.*
3. *Openings shall not permit the passage of spheres having a diameter greater than $^1/_2$ inch (13 mm) nor block the passage of spheres having a diameter less than $^3/_8$ inch (9.5 mm).*
4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

2113.9.3 Rain caps. Where a masonry or metal rain cap is installed on a masonry chimney, the net free area under the cap shall be not less than four times the net free area of the outlet of the chimney flue it serves.

2113.10 Wall thickness. Masonry chimney walls shall be constructed of concrete, solid masonry units or hollow masonry units grouted solid with not less than 4 inches (102 mm) nominal thickness.

2113.10.1 Masonry veneer chimneys. Where masonry is used as veneer for a framed chimney, through flashing and weep holes shall be provided as required by Chapter 14.

2113.11 Flue lining (material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and the manufacturer's instructions.

2113.11.1 Residential-type appliances (general). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C315.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

2113.11.1.1 Flue linings for specific appliances. Flue linings other than those covered in Section 2113.11.1 intended for use with specific appliances shall comply with Sections 2113.11.1.2 through 2113.11.1.4, 2113.11.2 and 2113.11.3.

2113.11.1.2 Gas appliances. Flue lining systems for gas appliances shall be in accordance with the *California Mechanical Code*.

2113.11.1.3 Pellet fuel-burning appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with Section 2113.11.1 and pellet vents listed for installation within masonry chimneys (see Section 2113.11.1.5 for marking).

2113.11.1.4 Oil-fired appliances approved for use with L-vent. Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining systems complying with Section 2113.11.1 and listed chimney liners complying with UL 641 (see Section 2113.11.1.5 for marking).

2113.11.1.5 Notice of usage. When a flue is relined with a material not complying with Section 2113.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: "This chimney is for use only with (type or category of appliance) that burns (type of fuel). Do not connect other types of appliances."

2113.11.2 Concrete and masonry chimneys for medium-heat appliances. Concrete and masonry chimneys for medium-heat appliances shall comply with Sections 2113.11.2.1 through 2113.11.2.5.

2113.11.2.1 Construction. Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls not less than 8 inches (203 mm) thick, or with stone masonry not less than 12 inches (305 mm) thick.

2113.11.2.2 Lining. Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick not less than $4^1/_2$ inches (114 mm) thick laid on the $4^1/_2$-inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start 2 feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

2113.11.2.3 Multiple passageway. Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum 4-inch-thick (102 mm) concrete or solid masonry wall.

2113.11.2.4 Termination height. Concrete and masonry chimneys for medium-heat appliances shall extend not less than 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

2113.11.2.5 Clearance. A minimum clearance of 4 inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

2113.11.3 Concrete and masonry chimneys for high-heat appliances. Concrete and masonry chimneys for high-heat appliances shall comply with 2113.11.3.1 through 2113.11.3.4.

2113.11.3.1 Construction. Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be not less than 8 inches (203 mm) thick with a minimum airspace of 2 inches (51 mm) between the walls.

2113.11.3.2 Lining. The inside of the interior wall shall be lined with an approved high-duty refractory brick, not less than $4^1/_2$ inches (114 mm) thick laid on the $4^1/_2$-inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

2113.11.3.3 Termination height. Concrete and masonry chimneys for high-heat appliances shall extend not less than 20 feet (6096 mm) higher than any portion of any building within 50 feet (15 240 mm).

2113.11.3.4 Clearance. Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection and maintenance operations on the chimney and prevent danger of burns to persons.

2113.12 Clay flue lining (installation). Clay flue liners shall be installed in accordance with ASTM C1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope not greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty nonwater-soluble refractory mortar conforming to ASTM C199 with tight mortar joints left smooth on the inside and installed to maintain an airspace or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

2113.13 Additional requirements.

2113.13.1 Listed materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and the manufacturer's instructions.

2113.13.2 Space around lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception: This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's instructions.

2113.14 Multiple flues. Where two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be not less than 4 inches (102 mm) thick and bonded into the walls of the chimney.

Exception: Where venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered not less than 4 inches (102 mm).

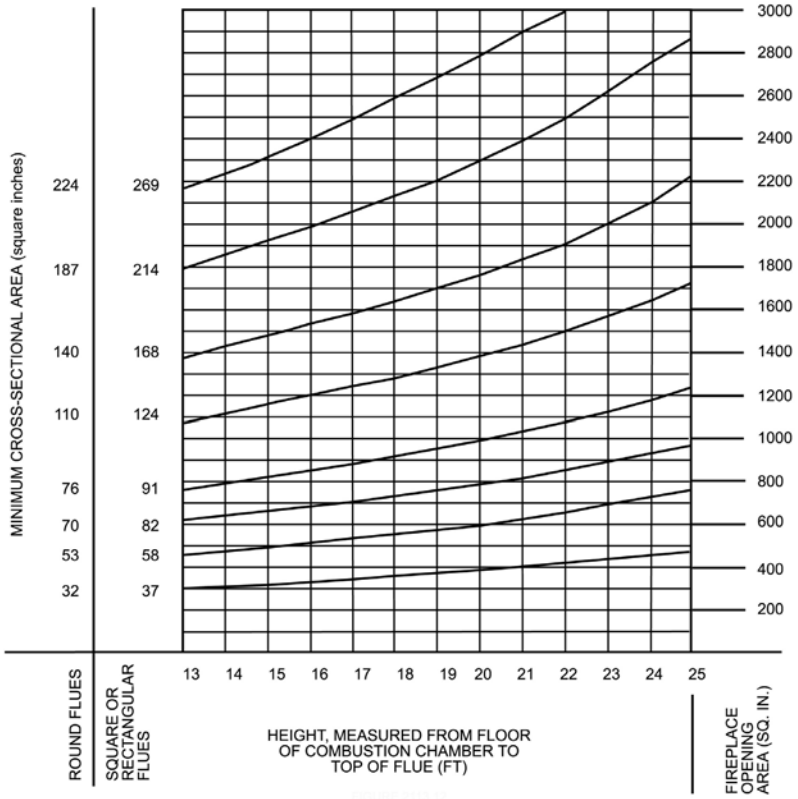
2113.15 Flue area (appliance). Chimney flues shall not be smaller in area than the area of the connector from the appliance. Chimney flues connected to more than one appliance shall be not less than the area of the largest connector plus 50 percent of the areas of additional chimney connectors.

Exceptions:

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the *California Mechanical Code*.

2113.16 Flue area (masonry fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113.16.1 or 2113.16.2.

FIGURE 2113.16—FLUE SIZES FOR MASONRY CHIMNEYS



Note: 1 inch = 25.4 mm, 1 square inch = 645 mm^2.

TABLE 2113.16(1)—NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES[a]	
FLUE SIZE, INSIDE DIAMETER (inches)	**CROSS-SECTIONAL AREA (square inches)**
6	28
7	38
8	50
10	78
$10^3/_4$	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.
a. Flue sizes are based on ASTM C315.

TABLE 2113.16(2)—NET CROSS-SECTIONAL AREA OF SQUARE AND RECTANGULAR FLUE SIZES	
FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	**CROSS-SECTIONAL AREA (square inches)**
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 ×13	127
12 × 16	131

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TABLE 2113.16(2)—NET CROSS-SECTIONAL AREA OF SQUARE AND RECTANGULAR FLUE SIZES—continued	
FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	**CROSS-SECTIONAL AREA (square inches)**
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431
For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.	

2113.16.1 Minimum area. Round chimney flues shall have a minimum net cross-sectional area of not less than $^1/_{12}$ of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of not less than $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of not less than $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of not less than $^1/_8$ of the fireplace opening.

2113.16.2 Determination of minimum area. The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113.16. A flue size providing not less than the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are as provided in Tables 2113.16(1) and 2113.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

2113.17 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

2113.18 Masonry chimney cleanout openings. Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located not less than 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be not less than 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

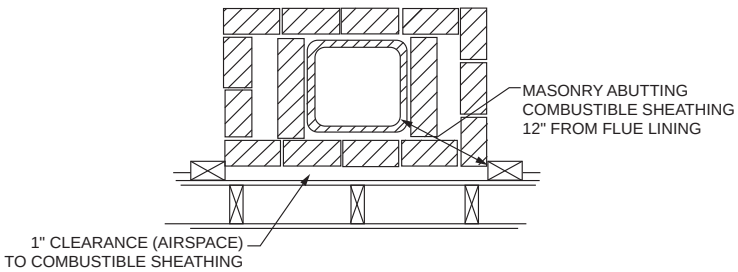
Exception: Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

2113.19 Chimney clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fireblocking in accordance with Section 2113.20.

Exceptions:

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's instructions, are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney sidewalls, in accordance with Figure 2113.19, provided that such combustible trim or sheathing is not less than 12 inches (305 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).

FIGURE 2113.19—ILLUSTRATION OF EXCEPTION THREE CHIMNEY CLEARANCE PROVISION



2113.20 Chimney fireblocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

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SECTION 2114—DRY-STACK MASONRY

2114.1 General. The design of dry-stack masonry structures shall comply with the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2114.2 through 2114.5.

2114.2 Limitations. Dry-stack masonry shall be prohibited in Risk Category IV structures.

2114.3 Materials. Concrete masonry units complying with ASTM C90 shall be used.

2114.4 Strength. Dry-stack masonry shall be of adequate strength and proportions to support all superimposed loads without exceeding the allowable stresses listed in Table 2114.4. Allowable stresses not specified in Table 2114.4 shall comply with the requirements of Chapter 8 of TMS 402.

TABLE 2114.4—GROSS CROSS-SECTIONAL AREA ALLOWABLE STRESS FOR DRY-STACK MASONRY

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression	45
Flexural tension Horizontal span Vertical span	 30 18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

2114.5 Construction. Construction of dry-stack masonry shall comply with ASTM C946.

SECTION 2115-ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

2115.1 General. *In addition to the provisions of this chapter, the following requirements shall apply to community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC).*

2115.1.1 Prohibitions. *The following design, systems and materials in TMS 402/602 are not permitted by DSA:*

1. *Unreinforced masonry.*
2. *Autoclaved aerated concrete (AAC) masonry.*
3. *Empirical design of masonry.*
4. *Adobe construction.*
5. *Ordinary reinforced masonry shear walls.*
6. *Intermediate reinforced masonry shear walls.*
7. *Prestressed masonry shear walls.*
8. *Direct design of masonry.*
9. *Design of masonry infill.*
10. *Prescriptive design of masonry partition walls.*
11. *Limit design method.*
12. *Glass fiber reinforced polymer (GFRP) reinforced masonry.*

2115.2 Masonry construction materials.

2115.2.1 Metal reinforcement and accessories. *The frequency of sampling for unidentifiable reinforcing bars may alternatively be in accordance with Section 1909.2.3.*

2115.2.2 Air entrainment. *Air-entraining substances shall not be used in grout.*

2115.2.3 Specified compressive strength of masonry and grout. *Replace TMS 402 Table 4.3.1 with the following.*

TABLE 4.3.1—SPECIFIED COMPRESSIVE STRENGTH REQUIREMENTS

TYPE OF MASONRY	SPECIFIED COMPRESSIVE STRENGTH OF MASONRY	SPECIFIED COMPRESSIVE STRENGTH OF GROUT
Concrete masonry	*2,000 psi (13.79 MPa)* ≤ f'_m ≤ *3,000 psi (20.68 MPa)*	$f'_g \geq f'_m \leq$ 5,000 psi (34.47 MPa)
Clay masonry	*1,500 psi (10.34 MPa)* ≤ f'_m ≤ *4,500 psi (31.02 MPa)*	$f'_g \leq$ 6,000 (41.37 MPa)

2115.3 Construction.

2115.3.1 Masonry construction. *Architectural cast stone construction shall be considered as an alternative system.*

2115.3.2 Reinforced grouted masonry.

2115.3.2.1 TMS 602, Article 3.3 B Placing mortar and units. *Modify TMS 602, Article 3.3 B.2.c as follows:*

c. Remove masonry protrusions extending *greater than* $^1/_4$ inch (*6.4* mm) into cells or cavities to be grouted.

2115.3.2.2 TMS 602, Article 3.4 B Reinforcement. *Modify TMS 602, Article 3.4 B.1 through Article 3.4 B.3 as follows:*

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar. *Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting.*
2. Completely embed reinforcing bars and *embedded items* in grout in accordance with Article 3.5.
3. Maintain clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $^1/_2$ inch (12.7 mm) *and a minimum of one bar diameter,* except where cross webs of hollow units are used as supports for horizontal reinforcement.

2115.3.2.3 TMS 602, Article 3.4 E Anchor bolts. *Replace TMS 602, Article 3.4 E.3 and add Articles 3.4 E.5 and 3.4 E.6 as follows:*

3. *Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $^1/_2$ inch (12.7 mm) of grout between the bolt circumference, the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least $^1/_4$ inch (6.4 mm) when using fine grout and at least $^1/_2$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.*
5. *Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be $^1/_2$-inch (12.7 mm) diameter for 6-inch (152 mm) nominal masonry, $^3/_4$-inch (19.1 mm) diameter for 8-inch (203 mm) nominal masonry, $^7/_8$-inch (22.2 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25.4 mm) diameter for 12-inch (305 mm) nominal masonry.*
6. *Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.*

2115.3.2.4 TMS 602, Article 3.5 A Placing time. *Modify TMS 602, Article 3.5 A by adding Article 3.5 A.3 as follows:*

3. *The grouting of any section of a wall between control barriers shall be completed in one day with no interruptions greater than one hour.*

2115.3.2.5 TMS 602, Article 3.5 F.1 Grout key. *Replace TMS 602, Article 3.5 F.1 as follows:*

1. *Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of $1^1/_2$ inches (38.1 mm) and a maximum of one-half the masonry unit height below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of $^1/_2$-inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25.4 mm) above reinforcing steel for each grout pour.*

2115.3.2.6 TMS 602, Article 3.5 Grout placement. *Add the following to TMS 602, Article 3.5:*

3.5 I. *Additional grouting requirements:*

1. *Place grout by pumping or an approved alternate method prior to initial set and loss of plasticity.*
2. *Place grout so that all spaces to be grouted do not contain voids.*
3. *Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.*

2115.3.2.7 Reinforced hollow unit masonry.

2115.3.2.7.1 TMS 602, Article 3.5 B Confinement. *Add the following to TMS 602, Article 3.5 B:*

2. *All cells shall be solidly filled with grout in reinforced hollow unit masonry.*

   Exception: *Reinforced hollow unit masonry laid in running bond used for freestanding site walls or interior nonbearing non-shear wall partitions may be grouted only in cells containing vertical and horizontal reinforcement.*

2115.4 Quality assurance.

2115.4.1 Mortar and grout tests. TMS 602, Article 1.4 B Compressive Strength Determination. *Modify TMS 602, Article 1.4 B as follows by adding:*

5. *Additional testing requirements:*
   a. *At the beginning of all masonry work, at least one test sample of the mortar shall be taken on three successive working days and at least at one-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C1714 and must be accompanied by corresponding certificates of compliance with current test reports, material certificates and delivery ticket. Documents shall be provided to the project inspector, DSA certified masonry inspector and laboratory of record.*
   b. *Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. The grout shall meet the minimum strength requirement given in ASTM C476/TMS 602 Section 2.2, or greater as specified.*
   c. *Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.*

d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

***Exception:** For nonbearing nonshear masonry walls not exceeding total wall height of 12 feet above the top of the foundation, mortar test shall be permitted to be limited to those at the beginning of masonry work for each mix design.*

***2115.4.2 Masonry core testing.** Two cores shall be taken from each building for each 5,000 square feet (465 m^2) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.*

Core samples shall comply with the following:

1. *Cored no sooner than 7 days after grouting of the selected area;*
2. *Be a minimum of $3^3/_4$ inches (96 mm) in nominal diameter; and*
3. *Sampled in such a manner as to exclude any masonry unit webs, mortar joint, or reinforcing steel. If all cells contain reinforcement, alternate core locations or means to detect void or delamination shall be selected by the registered design professional and approved by the building official.*

Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear test shall test both joints between the grout core and the outside wythes or face shell of the masonry 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or non-absorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of the cores shall not be less than 2.5 $\sqrt{f'_m}$ psi.

All cores shall be submitted to an approved agency for examination, including core specimens where an outside wythe or face shell separates from the grout core prior to shear testing, including during the coring operation. At this condition, a shear value of zero shall be assigned to the separated joint interface and the average unit shear value shall include this result. The approved agency shall report the location where each core was taken, the findings of their visual examination of each core, identify which cores were selected for shear testing, and the results of the shear tests. Additional cores shall be permitted to be taken at the direction of the registered design professional and with approval of the enforcement agency.

Exceptions:

1. *Core sampling and testing is not required for nonbearing nonshear masonry walls, not exceeding a total wall height of 12 feet above top of foundation, built with single-wythe hollow unit concrete masonry that attaches opposite face shells using webs cast as single unit, when designed using an f'_m not exceeding 2,000 psi (13.79 MPa).*
2. *An infrared thermographic survey or other nondestructive test procedures, shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in lieu of core sampling and testing.*

2115.5 Seismic design.

***2115.5.1 TMS 402, Section 5.4.1.4.** Replace TMS 402, Section 5.4.1.4 Items (a), (b), (d) & (e) by the following:*

(a) Vertical reinforcement shall be enclosed by lateral ties at least $^3/_8$ in. (12.7 mm) in diameter.

(b) Vertical spacing of lateral ties, *over the full height of the column,* shall not exceed *8* longitudinal bar diameters, *24* lateral tie bar diameters, *8 inches (203 mm)*, *or one-half the* least cross-sectional dimension of the member.

(d) Lateral ties shall be embedded in grout.

(e) Lateral ties shall be located vertically not more than one-half lateral tie spacing above the top of the footing or slab in any story, and shall be spaced not more than one-half a lateral tie spacing *nor 2 inches (51 mm)* below the lowest horizontal reinforcement in beam, girder, slab, or drop panel above. *The top tie shall be within 2 inches (51 mm) of the top of the column.*

***2115.5.2 TMS 402, Section 7.3.2.5 (i).** Replace first sentence of TMS 402, Section 7.3.2.5 (i) by the following:*

(i) When the ratio of $V/F_{vm}A_{mv}$ for masonry designed in accordance with Chapter 8 or when the ratio $V_u/\Phi V_{nm}$ for masonry designed in accordance with Chapter 9 exceeds *0.15, or the h_w/l_w exceeds 0.5*, the termination of horizontal reinforcement embedded in grout shall meet one of the following:

***2115.5.3 TMS 402, Sections 7.4.4.1 and 7.4.5.1.** Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:*

***7.4.4.1 Minimum reinforcement requirements for masonry walls.** The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. Where other than running bond is used in reinforced hollow unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.*

***Exception:** Reinforced hollow unit masonry used for freestanding site walls or interior nonbearing nonshear wall partitions shall have horizontal reinforcing spaced not more than 4 feet (1.2 m) on center, except for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement.*

***7.4.4.1.1** The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equally matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the*

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minimum area of reinforcement. Reinforcement with splices conforming to TMS 402 shall be considered as continuous reinforcement.

7.4.4.1.2 *Horizontal reinforcing bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.*

7.4.4.1.3 *In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement required elsewhere.*

7.4.4.1.4 *When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.*

7.4.4.1.5 *Joint reinforcement shall not be used as principal reinforcement in masonry.*

> ***2115.6 Allowable stress design.***

> ***2115.6.1 TMS 402, Section 8.3.4.4 Walls.*** *Modify TMS 402, Section 8.3.4.4 as follows by adding:*

Thickness of walls. *Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.*

The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio nor be less than the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.

Piers. *Every pier or wall section which width is less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section which width is between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.*

TABLE 8.3.4.4—MINIMUM THICKNESS OF MASONRY WALLS[1, 2]

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS[2,3]	NOMINAL MINIMUM THICKNESS (inches)
BEARING OR SHEAR WALLS:		
1. Stone masonry	14	16
2. Reinforced grouted masonry	25	6
3. Reinforced hollow unit masonry	25	6
NONBEARING WALLS:		
4. Exterior reinforced walls	30	6
5. Interior partitions reinforced	36	4

1. For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.
2. In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.
3. Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.

2115.7 Glass unit masonry construction. *Masonry glass block walls or panels shall be designated for seismic forces. Stresses in glass block shall not be utilized.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 21A – MASONRY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter								X		X				X										
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

21*A*

MASONRY

User notes:

About this chapter: *Chapter 21A provides comprehensive and practical requirements for masonry construction. Chapter 21A is applicable to structures regulated by the Division of the State Architect-Structural Safety—including public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Sections 1.9.2.1 [DSA-SS] and 1.9.2.2 [DSA-SS/CC])—and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development—including hospitals and correctional treatment centers (applications listed in Sections 1.10.1 [OSHPD 1] and 1.10.4 [OSHPD 4]).*

SECTION 2101*A*—GENERAL

2101*A*.1 Scope. This chapter shall govern the materials, design, construction and quality of masonry.

2101A.1.1 Application. *The scope of application of Chapter 21A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Applications listed in Sections 1.10.1 and 1.10.4 regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD). These applications include hospitals and correctional treatment centers.*

2101A.1.2 Amendments in this chapter. *DSA-SS and OSHPD 1 & 4 adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:*

   [DSA-SS] *For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Hospital Planning and Development:*

   [OSHPD 1] - *For applications listed in Section 1.10.1.*

   [OSHPD 4] - *For applications listed in Section 1.10.4.*

2101A.1.3 Prohibition. *The following design methods, systems and materials in TMS 402/602 are not permitted by DSA-SS and OSHPD:*

1. *Unreinforced masonry.*
2. *Autoclaved aerated concrete (AAC) masonry.*
3. *Empirical design of masonry.*
4. *Adobe construction.*
5. *Ordinary reinforced masonry shear walls.*
6. *Intermediate reinforced masonry shear walls.*
7. *Prestressed masonry shear walls.*
8. *Direct design of masonry.*
9. *Design of masonry infill.*
10. *Prescriptive design of masonry partition walls.*
11. *Limit design method.*
12. *Glass fiber reinforced polymer (GFRP) reinforced masonry.*

2101*A*.2 Design methods. Masonry shall comply with the provisions of TMS 402 or TMS 404 as well as applicable requirements of this chapter.

2101*A*.2.1 Masonry veneer. Masonry veneer shall comply with the provisions of Chapter 14.

2101*A*.3 Special inspection. The special inspection of masonry shall be as defined in Chapter 17*A*, or an itemized testing and inspection program shall be provided that meets or exceeds the requirements of Chapter 17*A*.

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SECTION 2102*A*—NOTATIONS

2102*A*.1 General. The following notations are used in the chapter:

NOTATIONS.

d_b = Diameter of reinforcement, inches (mm).

F_s = Allowable tensile or compressive stress in reinforcement, psi (MPa).

f_r = Modulus of rupture, psi (MPa).

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

L_s = Distance between supports, inches (mm).

l_d = Required development length or lap length of reinforcement, inches (mm).

P = The applied load at failure, pounds (N).

S_t = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

S_w = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

SECTION 2103*A*—MASONRY CONSTRUCTION MATERIALS

2103*A*.1 Masonry units. Concrete masonry units, clay or shale masonry units, stone masonry units, glass unit masonry shall comply with Article 2.3 of TMS 602. Architectural cast stone shall conform to TMS 504. *Architectural cast stone construction shall be considered as an alternative system.*

Exception: Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Table 705.5.

2103*A*.1.1 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

2103*A*.2 Mortar. Mortar for masonry construction shall comply with Section 2103*A*.2.1, 2103*A*.2.2, 2103*A*.2.3 or 2103*A*.2.4.

2103*A*.2.1 Masonry mortar. Mortar for use in masonry construction shall conform to Articles 2.1 and 2.6 A of TMS 602.

2103*A*.2.2 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

2103*A*.2.3 Mortars for ceramic wall and floor tile. Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103*A*.2.3.

TABLE 2103*A*.2.3—CERAMIC TILE MORTAR COMPOSITIONS

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $^1/_5$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $^1/_2$ hydrated lime; 5 damp sand to 1 cement; 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $^1/_{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $^1/_2$ hydrated lime; $2^1/_2$ dry sand or 3 damp sand

2103*A*.2.3.1 Dry-set Portland cement mortars. Premixed prepared Portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A108.5.

2103*A*.2.3.2 Latex-modified Portland cement mortar. Latex-modified Portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified Portland cement shall be installed in accordance with ANSI A108.5.

2103*A*.2.3.3 Epoxy mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2103*A*.2.3.4 Furan mortar and grout. Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2103*A*.2.3.5 Modified epoxy-emulsion mortar and grout. Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2103*A*.2.3.6 Organic adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall be not less than 40 psi (275 kPa) for Type I adhesive and not

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less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2103*A*.2.3.7 Portland cement grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

2103*A*.2.4 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to Section 13.3 of TMS 402.

2103*A*.3 Grout. Grout shall comply with Article 2.2 of TMS 602.

2103A.3.1 Aggregate. *Coarse grout shall be used in grout spaces between wythes of 2 inches (50.8 mm) or more in width as determined in accordance with TMS 602 Table 7, footnote 3, and in all grouted cells of hollow unit masonry construction.*

2103*A*.4 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602. Where unidentified reinforcement, *or bar reinforcement without mill certification,* is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work. *Alternatively, the frequency of sampling for unidentifiable reinforcing bars specified in Section 1910A.2 can be used.*

2103A.5 Air entrainment. *Air-entraining materials or air-entraining admixtures shall not be used in grout.*

2103A.6 Specified compressive strength of masonry and grout*. Replace TMS 402 Table 4.3.1 by the following:*

TABLE 4.3.1—SPECIFIED COMPRESSIVE STRENGTH REQUIREMENTS

TYPE OF MASONRY	SPECIFIED COMPRESSIVE STRENGTH OF MASONRY	SPECIFIED COMPRESSIVE STRENGTH OF GROUT
Concrete masonry	*2,000 psi (13.79 MPa)* ≤ f'_m ≤ *3,000 psi (20.68 MPa)*	$f'_g \geq f'_m \leq$ 5,000 psi (34.47 MPa)
Clay masonry	*1,500 psi (10.34 MPa)* ≤ f'_m ≤ *4,500 psi (31.02 MPa)*	$f'_g \leq$ 6,000 (41.37 MPa)

SECTION 2104*A*—CONSTRUCTION

2104*A*.1 Masonry construction. Masonry construction shall comply with the requirements of Sections 2104*A*.1.1 *through* 2104*A*.1.3 and with the requirements of either TMS 602 or TMS 604.

2104*A*.1.1 Support on wood. Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304*A*.13.

2104*A*.1.2 Molded cornices. Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

2104A.1.3 Reinforced grouted masonry.

2104A.1.3.1 [DSA-SS] TMS 602, Article 3.2 F Cleanouts. *Replace TMS 602, Article 3.2 F with the following:*

3.2 F. *Cleanouts* - Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds *the height limits given in Section 2104A.1.3.5 Item 3.*

1. *Cleanout openings in hollow unit masonry shall be provided in every cell at the bottom of each pour of grout. Alternatively, if the course at the bottom of the pour is constructed entirely of inverted double open-end bond beam units, cleanout openings need only be provided for access to every reinforced cell at the bottom of each pour of grout.*
2. *Cleanouts in multi-wythe masonry shall be provided for each pour by leaving out every other unit in the bottom wythe of the section being poured or by cleanout openings in the foundation.*
3. *The foundation or other horizontal construction joints at the cleanouts shall be cleaned of all loose material and mortar droppings before each pour. The cleanouts shall be sealed after inspection and before grouting.*

2104A.1.3.2 TMS 602, Article 3.3 B Placing mortar and units. *Modify TMS 602, Article 3.3 B.2.c as follows:*

c. Remove masonry protrusions extending *greater than* $^1/_4$ inch (*6.4* mm) into cells or cavities to be grouted.

2104A.1.3.3 TMS 602, Article 3.4 B Reinforcement. *Modify TMS 602, Article 3.4 B.1 through Article 3.4 B.3 as follows:*

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar. *Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting.*
2. Completely embed reinforcing bars and *embedded items* in grout in accordance with Article 3.5.
3. Maintain clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $^1/_2$ inch (12.7 mm), *and a minimum of one bar diameter,* except where cross webs of hollow units are used as supports for horizontal reinforcement.

2104A.1.3.4 TMS 602, Article 3.4 E Anchor bolts. *Replace TMS 602, Article 3.4 E.3 and add Articles 3.4 E.5 and 3.4 E.6 as follows:*

3. *Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $^1/_2$ inch (12.7 mm) of grout between the bolt circumference and the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and*

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the formed surface of grout of at least $^1/_4$ inch (6.4 mm) when using fine grout and at least $^1/_2$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.

5. *Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be $^1/_2$-inch (12.7 mm) diameter for 6-inch (152 mm) nominal masonry, $^3/_4$-inch (19.1 mm) diameter for 8-inch (203 mm) nominal masonry, $^7/_8$-inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25.4 mm) diameter for 12-inch (305 mm) nominal masonry.*
6. *Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.*

2104A.1.3.5 [DSA-SS] TMS 602, Article 3.5 C Grout pour height. *Replace TMS 602, Article 3.5 C and Table 7 as follows:*

1. Do not exceed the grout pour height given in Table 7. *Grout pours not terminated at the top of constructed masonry shall comply with TMS 602, Articles 3.5 C.3.a through 3.5 C.3.c.*
2. *The top of the grout pour shall be in the top course of the constructed masonry. Grout pours not terminated within the top course of the constructed masonry shall comply with TMS 602, Articles 3.5 C.3.a through 3.5 C.3.c.*
3. *Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider for hollow unit masonry shall be subject to approval of the enforcement agency and the following:*
   a. *Grouting shall be done in a continuous pour in lifts not exceeding the requirements of TMS 602, Article 3.5 D.*
   b. *The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.*
   c. *Cleanout openings shall be provided at the bottom of each pour of grout.*

TABLE 7—GROUT SPACE REQUIREMENTS

GROUT TYPE[1]	MAXIMUM GROUT POUR HEIGHT, FT (M)	MINIMUM CLEAR WIDTH OF GROUT SPACE,[2,3] IN. (MM)	MINIMUM CLEAR GROUT SPACE DIMENSIONS FOR GROUTING CELLS OF HOLLOW UNITS,[3] IN. × IN. (MM × MM)
Coarse	1 (0.3)	$2^1/_2$ *(63.5)*	*2* × 3 *(50.8* × 76.2)
Coarse	*4[4] (1.22)*	$2^1/_2$ *(63.5)*	$2^1/_2$ × 3 (63.5 × 76.2)
Coarse	12.67[5] (3.86)	$3^1/_2$ *(88.9)*	3 × 3[5] (76.2 × 76.2)

1. Coarse grout is defined in ASTM C476.
2. For grouting between masonry wythes.
3. Minimum clear width of grout space and minimum clear grout space dimension are the net dimension of the space determined by subtracting masonry protrusions and the diameters of horizontal reinforcement from the as-built cross section of the grout space.
4. *Maximum pour height can be increased to 5.33 feet for 10-inch nominal or wider hollow unit masonry.*
5. *Maximum pour height can be increased to 16 feet for hollow unit masonry walls with a nominal thickness of 12 inches or more and minimum clear grout space dimensions of 3 in. x 4 in. (76.2 mm x 102 mm).*

2104A.1.3.6 [DSA-SS] TMS 602, Article 3.5 D Grout lift height. *Modify TMS 602, Article 3.5 D as follows:*

3. *Grout lift height shall not exceed 4 feet (1219 mm).*

   Exception: *The 4 feet (1219 mm) maximum lift height may be increased to 5 feet 4 inches (1.63 m) for 10-inch (254 mm) nominal and larger hollow unit masonry.*

2104A.1.3.7 Reserved.

2104A.1.3.8 TMS 602, Article 3.5 F.1 Grout key. *Replace TMS 602, Article 3.5 F.1 as follows:*

1. *Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of $1^1/_2$ inches (38.1 mm) and a maximum of one-half the masonry unit height below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of $^1/_2$ inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25.4 mm) above reinforcing steel for each grout pour.*

2104A.1.3.9 TMS 602, Article 3.5 Grout placement. *Add the following to TMS 602, Article 3.5:*

3.5 I. *Additional grouting requirements:*

1. *Place grout by pumping or an approved alternate method prior to initial set and loss of plasticity.*
2. *Place grout so that all spaces to be grouted do not contain voids.*
3. *Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.*

2104A.1.3.10 Reinforced grouted multi-wythe masonry.

2104A.1.3.10.1 General. *Reinforced grouted multi-wythe masonry is that form of composite construction made with clay or shale brick or made with solid concrete building brick in which interior spaces of masonry are filled by pouring grout around reinforcement therein as the work progresses.*

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2104A.1.3.10.2 TMS 402, Section 5.1.3.2 Composite action. *Replace TMS 402, Section 5.1.3.2.1 by the following:*

5.1.3.2.1 Multiwythe masonry designed for composite action shall have wythes connected by collar joints and wall ties.

2104A.1.3.10.3 TMS 602, Article 3.3 B.4 Placing mortar and units – Solid units. *Add the following to TMS 602, Article 3.3 B.4:*

d. Toothing of masonry walls is prohibited. Racking is to be held to a minimum.

2104A.1.3.10.4 TMS 602, Article 3.4 C.2 Wall ties. *Replace TMS 602, Article 3.4 C.2 as follows:*

2. The two wythes shall be bonded together with wall ties. Ties shall not be less than No. 9 (W1.7) wire in the form of rectangles 4 inches (102 mm) wide and 2 inches (50.8 mm) in length less than the overall wall thickness. Kinks, water drips or deformations shall not be permitted in the ties. One wythe of the wall shall be built up not more than 16 inches (406 mm) ahead of the other wythe. Ties shall be laid not to exceed 24 inches (610 mm) on center horizontally and 16 inches (406 mm) on center vertically for running bond, and not more than 24 inches (610 mm) on center horizontally and 12 inches (305 mm) on center vertically for other than running bond.

2104A.1.3.10.5 TMS 602, Article 3.5 B Confinement. *Add the following to TMS 602, Article 3.5 B:*

1. Construct vertical grout barriers or dams of solid masonry across the grout space the entire height of the wall to control horizontal grout flow. Space grout barriers not more than 30 feet (9.14 m) apart.

2104A.1.3.11 Reinforced hollow unit masonry.

2104A.1.3.11.1 TMS 602, Article 2.3 A & 2.3 B Masonry unit materials. *Add the following to TMS 602, Articles 2.3 A and 2.3 B:*

1. In reinforced hollow unit masonry, place horizontal reinforcement in bond beam units. The depth of the bond beam channel below the top of the unit shall be $1^1/_2$ inches (38.1 mm) minimum and the width shall be 3 inches (76.2 mm) minimum.

2104A.1.3.11.2 TMS 602, Article 3.5 B Confinement. *Add the following to TMS 602, Article 3.5 B:*

2. All cells shall be solidly filled with grout in reinforced hollow unit masonry.

Exception: *Reinforced hollow unit masonry laid in running bond used for freestanding site walls or interior nonbearing non-shear wall partitions may be grouted only in cells containing vertical and horizontal reinforcement.*

*3. **[DSA-SS]** Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear grout space dimension of not less than that given in Section 2104A.1.3.5, Table 7.*

SECTION 2105*A*—QUALITY ASSURANCE

2105*A*.1 General. A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the approved construction documents.

The quality assurance program shall comply with the inspection and testing requirements of Chapter 17*A* and TMS 602 *and Sections 2105A.2 through 2105A.4.*

2105A.2 Compressive strength, f'_m. *Testing of masonry shall be provided in accordance with TMS 602, Article 1.4 B.*

Exception: *Where values of f'_m greater than 2000 psi (13.79 MPa) are used in the design of reinforced grouted multi-wythe masonry and reinforced hollow unit masonry, they shall be based on prism test results in accordance with TMS 602, Article 1.4 B.3 submitted by the architect or engineer to the enforcement agency which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength.*

The architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract documents. Verification of compliance with the requirements for the specified strength of masonry during construction shall be provided using prism test method in accordance with TMS 602, Article 1.4 B.3. Verification of compliance with the specified compressive strength prior to the start of construction shall be obtained by using the prism test method in accordance with TMS 602, Article 1.4 B.3.

2105A.3 Mortar and grout tests. TMS 602, Article 1.4 B Compressive Strength Determination. *Modify TMS 602, Article 1.4 B as follows by adding:*

5. Additional testing requirements:

*a. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at least at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. **[DSA-SS]** Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C1714 and must be accompanied by corresponding certificates of compliance with current test reports, material certificates and delivery ticket. Documents shall be provided to the project inspector, DSA certified masonry inspector and laboratory of record. **[OSHPD 1 & 4]** Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C1714 with a material certificate.*

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b. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. They shall meet the minimum strength requirement given in ASTM C476/TMS 602, Section 2.2, or greater as specified.

c. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.

d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

***Exception:** For nonbearing non-shear masonry walls not exceeding total wall height of 12 feet above top of foundation, mortar tests shall be permitted to be limited to those at the beginning of masonry work for each mix design.*

***2105A.4 Masonry core testing.** Two cores shall be taken from each building for each 5,000 square feet (465 m^2) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.*

Core samples shall comply with the following:

1. *Cored no sooner than 7 days after grouting of the selected area;*
2. *Be a minimum of $3^3/_4$ inches in nominal diameter; and*
3. *Sampled in such a manner as to exclude any masonry unit webs, mortar joint, or reinforcing steel. If all cells contain reinforcement, alternate core locations or means to detect void or delamination shall be selected by the registered design professional and approved by the building official.*

Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear test both joints between the grout core and the outside wythes or face shell of the masonry 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or non-absorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of core shall not be less than 2.5 $\sqrt{f'_m}$ psi.

*All cores shall be submitted to an approved agency for examination, including core specimens where an outside wythe or face shell separates from the grout core prior to shear testing, including during the coring operation. **[DSA-SS]** At this condition, a shear value of zero shall be assigned to the separated joint interface and the average unit shear value shall include this result.*

The approved agency shall report the location where each core was taken, the findings of their visual examination of each core, identify which cores were selected for shear testing, and the results of the shear tests. Additional cores shall be permitted to be taken at the direction of the registered design professional and with approval of the enforcement agency.

Exceptions:

1. *Core sampling and testing is not required for non-bearing nonshear masonry walls, not exceeding a total wall height of 12 feet above top of foundation, built with single-wythe hollow unit concrete masonry that attaches opposite face shells using webs cast as single unit, when designed using an f'_m not exceeding 2,000 psi (13.79 MPa).*
2. *An infrared thermographic survey or other nondestructive test procedures, shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in lieu of core sampling and testing. **[OSHPD 1 & 4]** Infrared thermographic surveys or other nondestructive test procedures shall also include core tests with a minimum of two cores taken from each building for each 10,000 square feet (930 m^2) of the wall.*

SECTION 2106*A*—SEISMIC DESIGN

2106*A*.1 Seismic design requirements for masonry. Masonry structures and components shall comply with the requirements in Chapter 7 of TMS 402 depending on the structure's seismic design category.

***2106A.1.1 TMS 402, Section 5.4.1.4.** Replace TMS 402, Section 5.4.1.4 Items (a), (b), (d) & (e) by the following:*

(a) Vertical reinforcement shall be enclosed by lateral ties at least $^3/_8$ in. (*9.5 mm*) in diameter.

(b) Vertical spacing of lateral ties, *over the full height of the column,* shall not exceed *8* longitudinal bar diameters, *24* lateral tie bar diameters, *8 inches (203 mm)*, *or one-half the* least cross-sectional dimension of the member.

(d) Lateral ties shall be embedded in grout.

(e) Lateral ties shall be located vertically not more than one-half lateral tie spacing above the top of the footing or slab in any story, and shall be spaced not more than one-half a lateral tie spacing *nor 2 inches (51 mm)* below the lowest horizontal reinforcement in beam, girder, slab, or drop panel above. *The top tie shall be within 2 inches (51 mm) of the top of the column.*

***2106A.1.2 TMS 402, Chapter 5.** Add TMS 402, Section 5.7 as follows:*

5.7 – Lateral Support of Members

5.7.1 – Lateral support of masonry may be provided by cross walls, columns, pilasters, counterforts or buttresses where spanning horizontally, or by floors, beams, girts or roofs where spanning vertically. Where walls are supported laterally by vertical elements, the stiffness of each vertical element shall exceed that of the tributary area of the wall.

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2106A.1.3 TMS 402, Section 7.3.2.5 (i). *Replace first sentence of TMS 402, Section 7.3.2.5 (i) by the following:*

(i) When the ratio of $V/F_{vm}A_{mv}$ for masonry designed in accordance with Chapter 8 or when the ratio $V_u/\Phi V_{nm}$ for masonry design in accordance with Chapter 9 exceeds *0.15, or the h_w/l_w exceeds 0.5*, the termination of horizontal reinforcement embedded in grout shall meet one of the following:

2106A.1.4 TMS 402, Sections 7.4.4.1 and 7.4.5.1. *Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:*

7.4.4.1 Minimum reinforcement requirements for masonry walls. *The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. Where other than running bond is used in reinforced hollow unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.*

Exception: *Reinforced hollow unit masonry used for freestanding site walls or interior nonbearing nonshear wall partitions shall have horizontal reinforcing spaced not more than 4 feet (1.2 m) on center, except for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement.*

7.4.4.1.1 *The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equally matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402 shall be considered as continuous reinforcement.*

7.4.4.1.2 *Horizontal reinforcing bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.*

7.4.4.1.3 *In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement required elsewhere.*

7.4.4.1.4 *When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.*

7.4.4.1.5 *Joint reinforcement shall not be used as principal reinforcement in masonry.*

SECTION 2107*A*—ALLOWABLE STRESS DESIGN

2107*A*.1 General. The design of masonry structures using allowable stress design shall comply with Section 2106 and the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2107*A*.2 through *2107A.4.*

2107*A*.2 TMS 402, Section 6.1.7.1, lap splices. As an alternative to Section 6.1.7.1, it shall be permitted to design lap splices in accordance with Section 2107*A*.2.1.

2107*A*.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d, shall be:

Equation 21*A*-1 $l_d = 0.002 d_b f_s$

For SI: $l_d = 0.29 d_b f_s$

but not less than 12 inches (305 mm). The length of the lapped splice shall be not less than 40 bar diameters.

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of F_s, the lap length of splices shall be increased not less than 50 percent of the minimum required length, but need not be greater than 72 d_b. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

2107*A*.3 TMS 402, Section 6.1.7, splices of reinforcement. Add to Section 6.1.7 as follows:

6.1.7 – Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. Welding shall conform to AWS D1.4. Welded splices shall be of ASTM A706 steel reinforcement. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section 6.1.7.2.

2107A.4 TMS 402, Section 8.3.4.4 Walls. *Modify TMS 402, Section 8.3.4.4 as follows by adding:*

8.3.4.4.1 *The minimum thickness of walls is given in this section. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.*

8.3.4.4.2 *The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio nor be less than the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.*

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TABLE 8.3.4.4-MINIMUM THICKNESS OF MASONRY WALLS[1, 2]		
TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS[2,3]	NOMINAL MINIMUM THICKNESS (inches)
BEARING OR SHEAR WALLS:		
1. Stone masonry	*14*	*16*
2. Reinforced grouted masonry	*25*	*6*
3. Reinforced hollow unit masonry	*25*	*6*
NONBEARING WALLS:		
4. Exterior reinforced walls	*30*	*6*
5. Interior partitions reinforced	*36*	*4*

1. *For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.*
2. *In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.*
3. *Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.*

8.3.4.4.3 *Every pier or wall section with a width less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section with a width between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.*

SECTION 2108*A*—STRENGTH DESIGN OF MASONRY

2108*A*.1 General. The design of masonry structures using strength design shall comply with Section 2106 and the requirements of Chapters 1 through 7 and Chapter 9 of TMS 402, except as modified by Sections 2108*A*.2 through 2108*A*.3.

2108*A*.2 TMS 402, Section 6.1.6, development. Add a second paragraph to Section 6.1.6 as follows:

The required development length of reinforcement need not be greater than 72 d_b.

2108*A*.3 TMS 402, Section 6.1.6.1.1, splices. Add to Sections 6.1.7.2.1 and 6.1.7.3.1 as follows:

6.1.7.3.1 – Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls.

6.1.7.2.1 – Mechanical splices shall be classified as Type 1 or 2 in accordance with Section 18.2.7.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special reinforced masonry shear walls. Type 2 mechanical splices are permitted in any location within a member.

SECTION 2109*A*—EMPIRICAL DESIGN OF ADOBE MASONRY

Not permitted by OSHPD and DSA.

SECTION 2110*A*—GLASS UNIT MASONRY

2110*A*.1 General. Glass unit masonry construction shall comply with Chapter 14 of TMS 402 and this section.

Masonry glass block walls or panels shall be designed for seismic forces. Stresses in glass block shall not be utilized.

2110*A*.1.1 Limitations. Solid or hollow approved glass block shall not be used in fire walls, party walls, fire barriers, fire partitions or smoke barriers, or for load-bearing construction. Such blocks shall be erected with mortar and reinforcement in metal channel-type frames, structural frames, masonry or concrete recesses, embedded panel anchors as provided for both exterior and interior walls or other approved joint materials. Wood strip framing shall not be used in walls required to have a fire-resistance rating by other provisions of this code.

Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than $^3/_4$ hour shall be permitted as opening protectives in accordance with Section 716 in fire barriers, fire partitions and smoke barriers that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways and ramps or exit passageways.
2. Glass-block assemblies as permitted in Section 404.6, Exception 2.

SECTION 2111*A*—MASONRY FIREPLACES

2111*A*.1 General. The construction of masonry fireplaces, consisting of concrete or masonry, shall be in accordance with this section.

2111*A*.2 Fireplace drawings. The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be indicated.

2111*A*.3 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (153 mm) beyond the face of the fireplace or

foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2111*A*.3.1 Ash dump cleanout. Cleanout openings, located within foundation walls below fireboxes, where provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

2111*A*.4 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry fireplaces shall be reinforced and anchored in accordance with Sections 2111*A*.4.1, 2111*A*.4.2 and 2111*A*.5. In structures assigned to Seismic Design Category E or F, masonry fireplaces shall be reinforced in accordance with the requirements of Sections 2101*A* through 2108*A*.

2111*A*.4.1 Vertical reinforcing. For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103.3. For fireplaces with chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2111*A*.4.2 Horizontal reinforcing. Vertical reinforcement shall be placed enclosed within $^1/_4$-inch (6.4 mm) ties or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete; or placed in the bed joints of unit masonry at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2111*A*.5 Seismic anchorage. Masonry fireplaces and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two $^3/_{16}$-inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not fewer than four floor joists with two $^1/_2$-inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

2111*A*.6 Firebox walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Where a lining of firebrick not less than 2 inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and sidewalls shall each be 8 inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall be not greater than $^1/_4$ inch (6.4 mm). Where a lining is not provided, the total minimum thickness of back and sidewalls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C27 or ASTM C1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C199.

2111*A*.6.1 Steel fireplace units. Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace provided that they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than $^1/_4$ inch (6.4 mm) in thickness, and an air-circulating chamber that is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

2111*A*.7 Firebox dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall be not less than 8 inches (203 mm) above the fireplace opening. The throat opening shall be not less than 4 inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall be not less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is not less than 12 inches (305 mm) and not less than one-third of the width of the fireplace opening, and the throat is not less than 12 inches (305 mm) above the lintel, and not less than $^1/_{20}$ the cross-sectional area of the fireplace opening.

2111*A*.8 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located not less than 8 inches (203 mm) above the top of the fireplace opening.

2111*A*.8.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located not less than 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

2111*A*.9 Smoke chamber walls. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. The total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of solid masonry. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C199. Where a lining of firebrick not less than 2 inches (51 mm) thick, or a lining of vitrified clay not less than $^5/_8$ inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C1261 and shall be laid with refractory mortar conforming to ASTM C199. Vitrified clay linings shall conform to ASTM C315.

2111*A*.9.1 Smoke chamber dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall be not greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical where prefabricated smoke chamber linings are used or where the smoke

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chamber walls are rolled or sloped rather than corbeled. Where the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

2111*A*.10 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. Combustible material shall not remain against the underside of hearths or hearth extensions after construction.

2111*A*.10.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

2111*A*.10.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: Where the bottom of the firebox opening is raised not less than 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than $^3/_8$-inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

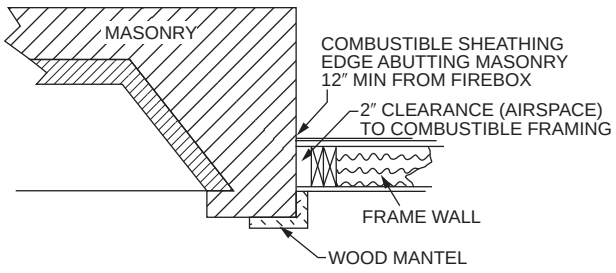
2111*A*.11 Hearth extension dimensions. Hearth extensions shall extend not less than 16 inches (406 mm) in front of, and not less than 8 inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557 m^2) or larger, the hearth extension shall extend not less than 20 inches (508 mm) in front of, and not less than 12 inches (305 mm) beyond, each side of the fireplace opening.

2111*A*.12 Fireplace clearance. Any portion of a masonry fireplace located in the interior of a building or within the exterior wall of a building shall have a clearance to combustibles of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section 2111*A*.13.

Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's instructions are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and drywall, are permitted to abut the masonry fireplace sidewalls and hearth extension, in accordance with Figure 2111*A*.12, provided that such combustible trim or sheathing is not less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening, provided that such combustible materials shall not be placed within 6 inches (153 mm) of a fireplace opening. Combustible material directly above and within 12 inches (305 mm) of the fireplace opening shall not project more than $^1/_8$ inch (3.2 mm) for each 1-inch (25 mm) distance from such opening. Combustible materials located along the sides of the fireplace opening that project more than $1^1/_2$ inches (38 mm) from the face of the fireplace shall have an additional clearance equal to the projection.

FIGURE 2111*A*.12—ILLUSTRATION OF EXCEPTION TO FIREPLACE CLEARANCE PROVISION



For SI: 1 inch = 25.4 mm

2111*A*.13 Fireplace fireblocking. All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

2111*A*.14 Exterior air. Factory-built or masonry fireplaces covered in this section shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

2111*A*.14.1 Factory-built fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be listed components of the fireplace, and installed according to the fireplace manufacturer's instructions.

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2111*A*.14.2 Masonry fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

2111*A*.14.3 Exterior air intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within a garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of $^1/_4$-inch (6.4 mm) mesh.

2111*A*.14.4 Clearance. Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

2111*A*.14.5 Passageway. The combustion air passageway shall be not less than 6 square inches (3870 mm^2) and not more than 55 square inches (0.035 m^2), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer's instructions.

2111*A*.14.6 Outlet. The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

SECTION 2112*A*—MASONRY HEATERS

2112*A*.1 Definition. A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as "masonry," which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes flow in either a horizontal or downward direction before entering the chimney and which delivers heat by radiation from the masonry surface of the heater.

2112*A*.2 Installation. Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E1602.
2. Masonry heaters shall be listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer's instructions.

2112*A*.3 Footings and foundation. The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section 2113*A*.2.

2112*A*.4 Seismic reinforcing. In structures assigned to Seismic Design Category D, E or F, masonry heaters shall be anchored to the masonry foundation in accordance with Section 2113*A*.3. Seismic reinforcing shall not be required within the body of a masonry heater with a height that is equal to or less than 3.5 times its body width and where the masonry chimney serving the heater is not supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with Section 2113*A*.

2112*A*.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (914 mm) or the distance of the allowed reduction method from the outside surface of a masonry heater in accordance with NFPA 211, Section 12.6, and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. Where the masonry heater wall thickness is not less than 8 inches (203 mm) of solid masonry and the wall thickness of the heat exchange channels is not less than 5 inches (127 mm) of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of not less than 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer's instructions.

SECTION 2113*A*—MASONRY CHIMNEYS

2113*A*.1 General. The construction of masonry chimneys consisting of solid masonry units, hollow masonry units grouted solid, stone or concrete shall be in accordance with this section.

2113*A*.2 Footings and foundations. Footings for masonry chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2113*A*.3 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry chimneys shall be reinforced and anchored in accordance with Sections 2113*A*.3.1, 2113*A*.3.2 and 2113*A*.4. In structures assigned to Seismic Design Category E or F, masonry chimneys shall be reinforced in accordance with the requirements of Sections 2101 through 2108 and anchored in accordance with Section 2113*A*.4.

2113*A*.3.1 Vertical reinforcement. For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars anchored in the foundation shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103*A*.3. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2113*A*.3.2 Horizontal reinforcement. Vertical reinforcement shall be placed enclosed within $^1/_4$-inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete, or placed in the bed joints of unit masonry, at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2113*A*.4 Seismic anchorage. Masonry chimneys and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two $^3/_{16}$-inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not less than four floor joists with two $^1/_2$-inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

2113*A*.5 Corbeling. Masonry chimneys shall not be corbeled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

2113*A*.6 Changes in dimension. The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

2113*A*.7 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section 2113*A*.5.

2113*A*.8 Additional load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building.

2113*A*.9 Termination. Chimneys shall extend not less than 2 feet (610 mm) higher than any portion of the building within 10 feet (3048 mm), but shall be not less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

2113*A*.9.1 Chimney caps. Masonry chimneys shall have a concrete, metal or stone cap, sloped to shed water, a drip edge and a caulked bond break around any flue liners in accordance with ASTM C1283.

2113*A*.9.2 Spark arrestors. ***[SFM]*** *All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester.* The spark arrestor shall meet all of the following requirements:

1. The net free area of the spark arrestor shall not be less than four times the net free area of the outlet of the chimney.
2. The spark arrestor screen shall have heat and corrosion resistance equivalent to 12-gage wire, 19-gage galvanized steel or 24-gage stainless steel.
3. Openings shall not permit the passage of spheres having a diameter greater than $^1/_2$ inch (13 mm) nor block the passage of spheres having a diameter less than $^3/_8$ inch (9.5 mm).
4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

2113*A*.9.3 Rain caps. Where a masonry or metal rain cap is installed on a masonry chimney, the net free area under the cap shall be not less than four times the net free area of the outlet of the chimney flue it serves.

2113*A*.10 Wall thickness. Masonry chimney walls shall be constructed of concrete, solid masonry units or hollow masonry units grouted solid with not less than 4 inches (102 mm) nominal thickness.

2113*A*.10.1 Masonry veneer chimneys. Where masonry is used as veneer for a framed chimney, through flashing and weep holes shall be provided as required by Chapter 14.

2113*A*.11 Flue lining (material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and the manufacturer's instructions.

2113*A*.11.1 Residential-type appliances (general). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C315.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

2113*A*.11.1.1 Flue linings for specific appliances. Flue linings other than those covered in Section 2113*A*.11.1 intended for use with specific appliances shall comply with Sections 2113*A*.11.1.2 through 2113*A*.11.1.4, 2113*A*.11.2 and 2113*A*.11.3.

2113*A*.11.1.2 Gas appliances. Flue lining systems for gas appliances shall be in accordance with the *California Mechanical Code*.

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2113*A*.11.1.3 Pellet fuel-burning appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with Section 2113*A*.11.1 and pellet vents listed for installation within masonry chimneys (see Section 2113*A*.11.1.5 for marking).

2113*A*.11.1.4 Oil-fired appliances approved for use with L-vent. Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining systems complying with Section 2113*A*.11.1 and listed chimney liners complying with UL 641 (see Section 2113*A*.11.1.5 for marking).

2113*A*.11.1.5 Notice of usage. When a flue is relined with a material not complying with Section 2113*A*.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: "This chimney is for use only with (type or category of appliance) that burns (type of fuel). Do not connect other types of appliances."

2113*A*.11.2 Concrete and masonry chimneys for medium-heat appliances. Concrete and masonry chimneys for medium-heat appliances shall comply with Sections 2113*A*.11.2.1 through 2113*A*.11.2.5.

2113*A*.11.2.1 Construction. Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls not less than 8 inches (203 mm) thick, or with stone masonry not less than 12 inches (305 mm) thick.

2113*A*.11.2.2 Lining. Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick not less than $4^1/_2$ inches (114 mm) thick laid on the $4^1/_2$-inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start 2 feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

2113*A*.11.2.3 Multiple passageway. Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum 4-inch-thick (102 mm) concrete or solid masonry wall.

2113*A*.11.2.4 Termination height. Concrete and masonry chimneys for medium-heat appliances shall extend not less than 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

2113*A*.11.2.5 Clearance. A minimum clearance of 4 inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

2113*A*.11.3 Concrete and masonry chimneys for high-heat appliances. Concrete and masonry chimneys for high-heat appliances shall comply with 2113.11.3.1 through 2113.11.3.4.

2113*A*.11.3.1 Construction. Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be not less than 8 inches (203 mm) thick with a minimum airspace of 2 inches (51 mm) between the walls.

2113*A*.11.3.2 Lining. The inside of the interior wall shall be lined with an approved high-duty refractory brick, not less than $4^1/_2$ inches (114 mm) thick laid on the $4^1/_2$-inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

2113*A*.11.3.3 Termination height. Concrete and masonry chimneys for high-heat appliances shall extend not less than 20 feet (6096 mm) higher than any portion of any building within 50 feet (15 240 mm).

2113*A*.11.3.4 Clearance. Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection and maintenance operations on the chimney and prevent danger of burns to persons.

2113*A*.12 Clay flue lining (installation). Clay flue liners shall be installed in accordance with ASTM C1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope not greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty nonwater-soluble refractory mortar conforming to ASTM C199 with tight mortar joints left smooth on the inside and installed to maintain an airspace or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

2113*A*.13 Additional requirements.

2113*A*.13.1 Listed materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and the manufacturer's instructions.

2113*A*.13.2 Space around lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception: This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's instructions.

2113*A*.14 Multiple flues. Where two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be not less than 4 inches (102 mm) thick and bonded into the walls of the chimney.

Exception: Where venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered not less than 4 inches (102 mm).

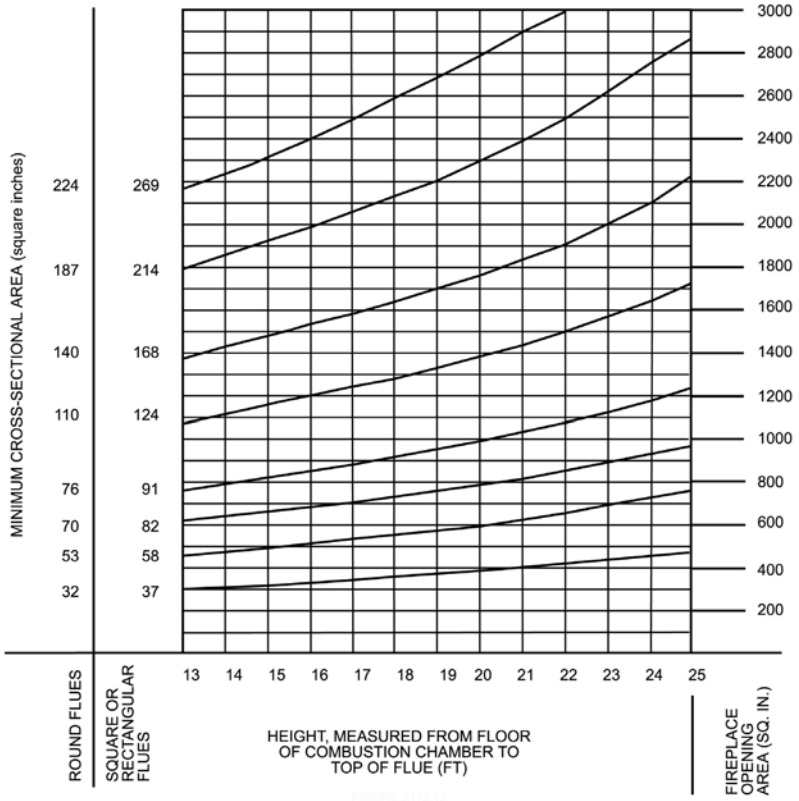
2113*A*.15 Flue area (appliance). Chimney flues shall not be smaller in area than the area of the connector from the appliance. Chimney flues connected to more than one appliance shall be not less than the area of the largest connector plus 50 percent of the areas of additional chimney connectors.

Exceptions:

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the *California Mechanical Code*.

2113*A*.16 Flue area (masonry fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113*A*.16.1 or 2113*A*.16.2.

FIGURE 2113*A*.16—FLUE SIZES FOR MASONRY CHIMNEYS



Note: 1 inch = 25.4 mm, 1 square inch = 645 mm^2.

TABLE 2113*A*.16(1)—NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES[a]

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
$10^3/_4$	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.
a. Flue sizes are based on ASTM C315.

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TABLE 2113*A*.16(2)—NET CROSS-SECTIONAL AREA OF SQUARE AND RECTANGULAR FLUE SIZES	
FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	**CROSS-SECTIONAL AREA (square inches)**
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 ×13	127
12 × 16	131
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431
For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.	

2113*A*.16.1 Minimum area. Round chimney flues shall have a minimum net cross-sectional area of not less than $^1/_{12}$ of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of not less than $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of not less than $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of not less than $^1/_8$ of the fireplace opening.

2113*A*.16.2 Determination of minimum area. The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113*A*.16. A flue size providing not less than the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are as provided in Tables 2113*A*.16(1) and 2113*A*.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

2113*A*.17 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

2113*A*.18 Masonry chimney cleanout openings. Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located not less than 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be not less than 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

Exception: Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

2113*A*.19 Chimney clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fireblocking in accordance with Section 2113*A*.20.

Exceptions:

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's instructions, are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney sidewalls, in accordance with Figure 2113*A*.19, provided that such combustible trim or sheathing is not less than 12 inches (305 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).

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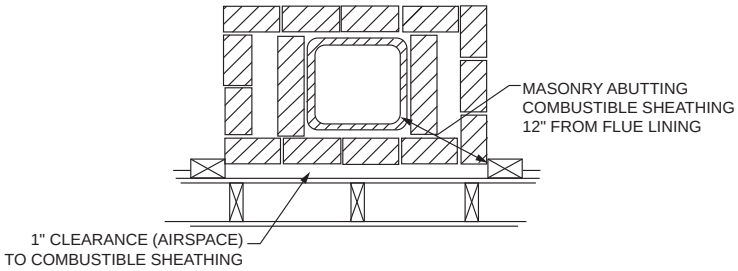
FIGURE 2113*A*.19—ILLUSTRATION OF EXCEPTION THREE CHIMNEY CLEARANCE PROVISION



2113*A*.20 Chimney fireblocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

SECTION 2114*A*—DRY-STACK MASONRY

2114*A*.1 General. The design of dry-stack masonry structures shall comply with the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2114*A*.2 through 2114*A*.5.

2114*A*.2 Limitations. Dry-stack masonry shall be prohibited in Risk Category IV structures.

2114*A*.3 Materials. Concrete masonry units complying with ASTM C90 shall be used.

2114*A*.4 Strength. Dry-stack masonry shall be of adequate strength and proportions to support all superimposed loads without exceeding the allowable stresses listed in Table 2114*A*.4. Allowable stresses not specified in Table 2114*A*.4 shall comply with the requirements of Chapter 8 of TMS 402.

TABLE 2114*A*.4—GROSS CROSS-SECTIONAL AREA ALLOWABLE STRESS FOR DRY-STACK MASONRY

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression	45
Flexural tension Horizontal span Vertical span	 30 18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

2114*A*.5 Construction. Construction of dry-stack masonry shall comply with ASTM C946.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 22 – STEEL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X			X	X								X			X								
Adopt entire chapter as amended (amended sections listed below)									X		X	X			X									
Adopt only those sections that are listed below																								
Chapter / Section																								
2201.1.1									X		X	X			X									
2201.1.2									X		X	X			X									
2201.1.3									X		X	X			X									
2201.1.4									X															
2201.1.5									X		X	X			X									
2201.4.1											X	X			X									
2201.5.1											X	X			X									
2202.1											X	X			X									
2202.2.1											X	X			X									
2202.2.1.2											X	X			X									
2202.2.2											X	X			X									
2202.3											X	X			X									
2202.4											X	X			X									
2207.4											X	X			X									
2207.6											X	X			X									
2208.1											X	X			X									
2204.2											X	X			X									
2206.1.1.2											X	X			X									
2206.1.3											X	X			X									
2206.2											X	X			X									
2214.1											X	X			X									
2215									X															
2216											X	X			X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

22 STEEL

User notes:

About this chapter: Chapter 22 provides the minimum requirements for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures and steel storage racks. This chapter specifies appropriate design and construction standards for these types of structures. It also provides a road map of the applicable technical requirements for steel structures. Chapter 22 requires that the design and use of steel structures and components be in accordance with the applicable specifications and standards of the American Institute of Steel Construction, the American Iron and Steel Institute, the Steel Joist Institute and the American Society of Civil Engineers.

This chapter was extensively reorganized for the 2024 edition. For complete information, see the relocations table in the Preface information of this code.

ICC code development note: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 2201—GENERAL

2201.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

2201.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 22 is as follows:*

1. *Structures regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD), which include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings, as listed in Sections 1.10.1, 1.10.2 and 1.10.5.*
2. *Structures regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.*

2201.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] *DSA-SS/CC, OSHPD adopt this chapter as amended.*

2201.1.3 Identification of amendments. [DSA-SS/CC, OSHPD]

1. ***[OSHPD 1R, 2 & 5]*** *Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 5] *- For applications listed in Section 1.10.5*
2. ***[DSA-SS/CC]*** *Division of the State Architect - Structural Safety/Community Colleges amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS/CC] *- For applications listed in Section 1.9.2.2*

2201.1.4 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapter 17, the provisions in Chapter 17A shall apply instead.*

2201.1.5 Additional amendments. [DSA-SS/CC] *See Section 2215 for additional requirements.*

2201.2 Identification. Identification of steel members shall be in accordance with the applicable referenced standards within this chapter. Other steel furnished for structural load-carrying purposes shall be identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards.

2201.3 Protection. The protection of steel members shall be in accordance with the applicable referenced standards within this chapter.

2201.4 Connections. The design and installation of steel connections shall be in accordance with the applicable referenced standards within this chapter. For special inspection of welding or installation of high-strength bolts, see Section 1705.2.

2201.4.1 Restrained welded connections. [OSHPD 1R, 2 & 5] *Welded structural steel connections having a medium or high level of restraint, as defined by AWS D1.1 Annex H, shall have a minimum pre-heat temperature of not less than 150°F (66°C). Welded structural steel connections with welds to flange, web, wall or plate having a high level of restraint shall maintain a post-heat temperature of 300°F (149°C) for a minimum of 1 hour after completion of welding.*

2201.5 Anchor rods. Anchor rods shall be set in accordance with the approved construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts, but shall not be greater than the length of the threaded portion of the bolts.

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2201.5.1 Shear transfer at column base plate. [OSHPD 1R, 2 & 5] *Where the holes in column base plates are more than $^1/_8$ inch (3 mm) larger than the anchor rods, as permitted by AISC 360, the anchor rods shall be designed for the induced bending stresses in combination with axial and shear stresses. Alternatively, shear lugs designed in accordance with ACI 318 Section 17.11 shall be permitted to transfer shear forces between column base plates and the supporting structure.*

SECTION 2202—STRUCTURAL STEEL AND COMPOSITE STRUCTURAL STEEL AND CONCRETE

2202.1 General. The design, fabrication and erection of structural steel elements and composite structural steel and concrete elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

Exceptions**: **[OSHPD 1R, 2 & 5]

1. *For members designed based on tension, the slenderness ratio (L/r) shall not exceed 300, except for the design of hangers and bracing in accordance with NFPA 13 and for rod hangers in tension.*
2. *For members designed based on compression, the slenderness ratio (KL/r) shall not exceed 200, except for the design of hangers and bracing in accordance with NFPA 13.*

2202.2 Seismic design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section 2202.2.1 or 2202.2.2, as applicable.

2202.2.1 Structural steel seismic force-resisting systems and composite structural steel and concrete seismic force-resisting systems. The design, detailing, fabrication and erection of structural steel seismic force-resisting systems and composite structural steel and concrete seismic force-resisting systems shall be in accordance with the provisions of Section 2202.2.1.1 or 2202.2.1.2, as applicable.

*[**OSHPD 1R, 2 & 5**] Seismic requirements for composite structural steel and concrete construction shall be considered as an alternative system, except as permitted by Section 2202.4.1.*

2202.2.1.1 Seismic Design Category B or C. Structures assigned to Seismic Design Category B or C shall be of any construction permitted in Section 2202. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1, is used for the design of structures assigned to Seismic Design Category B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341. Beam-to-column moment connections in structural steel special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358.

Exception: The response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, shall be permitted for structural steel systems designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.

2202.2.1.2 Seismic Design Category D, E or F. Structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341, except as permitted in ASCE 7, Table 15.4-1. Beam-to-column moment connections in structural steel special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358. ***[OSHPD 1R, 2 & 5]*** *All structural steel seismic force-resisting systems in ASCE 7 Table 15.4-1 shall be designed in accordance with AISC 341.*

2202.2.2 Structural steel elements. The design, detailing, fabrication and erection of structural steel elements in seismic force-resisting systems other than those covered in Section 2202.2.1, including struts, collectors, chords and foundation elements, shall be in accordance with AISC 341 where either of the following applies:

1. The structure is assigned to Seismic Design Category D, E or F, except as permitted in ASCE 7, Table 15.4-1.
2. A response modification coefficient, R, greater than 3 in accordance with ASCE 7, Table 12.2-1, is used for the design of the structure assigned to Seismic Design Category B or C.

[OSHPD 1R, 2 & 5] *All structural steel elements in seismic force-resisting systems shall satisfy the requirements in AISC 341.*

2202.3 Modifications to AISC 341. [OSHPD 1R, 2 & 5]

2202.3.1 Section A4. *Modify Section A4.1 Item (c) by adding the following:*

(c) Locations and dimensions of protected zones. The fabricator shall permanently mark protected zones of structural elements in the seismic force-resisting system in the building that are designated on the construction documents. If these markings are obscured during construction, such as after the application of fire protection, the owner's designated representative shall re-mark the protected zones as they are designated on the construction documents. Primers or paints used to mark protected zones on steel surfaces, which are to receive sprayed fire-resistance material, shall comply with California Building Code Section 704.13.3.2.

2202.3.2 Section I2. *Replace Section I2.1 item (d) as follows:*

(d) Decking attachments that penetrate the beam flange shall not be placed on beam flanges within the protected zone, except power-actuated fasteners up to 0.18 in. diameter are permitted, provided that the penetration is less than 85% of beam flange thickness.

2202.4 Modifications to AISC 358. [OSHPD 1R, 2 & 5]

2202.4.1 Modifications to AISC 358 Chapter 10. *Steel and concrete ConXtech ConXL composite special moment frame connections shall be permitted, provided:*

a. Beams are provided with Reduced Beam Sections (RBS);

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b. *Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $^1/_4$ inch fillet weld; and*

c. *The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $^1/_2$ inch.*

2202.4.2 Modifications to AISC 358 Chapter 11 Welded Moment Connection. *The welded sideplate steel moment connection shall be permitted, provided:*

1. *The beams shall consist of either rolled or built-up wide flange sections.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *For SMF and IMF systems, U-shaped cover plates shall be used and the hinge-to-hinge span to beam depth, L_h/d, shall be greater than or equal to 5.*
4. *The width-to-thickness ratios for beam flanges shall not be less than 3.*
5. *The spacing for lateral bracing of wide flange beams, L_b, shall include the length of the side plate at beam ends.*
6. *The extension of the side plates beyond the face of the column shall be within the range of 0.77d to 1.0d.*
7. *The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.*

   Exception: *The gap-to-side plate thickness ratio shall be permitted to be modified for moment connections with unequal beam sizes on opposite sides of the column or when orthogonal beams acting as drag connections frame into the side plate.*
8. *Demand critical fillet welds {2}, {5}, {5a} and {7} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches on either side of the start/stop location.*

2202.4.3 Modifications to AISC 358 Chapter 11 Bolted Moment Connection *The bolted sideplate steel moment connection shall be permitted, provided:*

1. *The beams shall consist of either rolled or built-up wide flange sections. Columns shall consist of rolled or built-up wide flange sections or noncomposite built-up box or HSS with a minimum wall thickness of $^3/_4$ inch (19 mm), or satisfy the requirements of width-to-thickness ratios of highly ductile members in AISC 341-16.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *For SMF and IMF systems, on the sideplate standard or configuration A the U-shaped cover plates shall be used with the k dimension extension. The k dimension extension length is defined as beam depth $d_b/6$, rounded to the nearest $^1/_2$ inch (12.7 mm).*
4. *The hinge-to-hinge span to beam depth, L_h/d, shall be greater than or equal to 4.5.*
5. *The width-to-thickness ratios for beam flanges shall not be less than 3.5.*

   Exception: *For width-to-thickness ratios less than 3.5 the C_{pr} shall be calculated in accordance with that for welded sideplate connections but in no case shall the width-to-thickness ratio be less than 3.0.*
6. *The minimum bolt-to-bolt spacing shall not be less than 3 bolt diameters.*
7. *The extension of the side plates beyond the face of the column shall be within the range of 0.65d to 1.5d.*
8. *The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.*

   Exception: *The gap-to-side plate thickness ratio shall be permitted to be modified for moment connections with unequal beam sizes on opposite sides of the column or when orthogonal beams acting as drag connections frame into the side plate.*
9. *Demand Critical fillet welds {2}, {5}, {5a} and {8} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch (152 mm) length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches (152 mm) on either side of the start/stop location.*
10. *The connection specific factor to account for peak connection strength, C_{pr}, shall be between 1.15 and 1.35. Calculations shall be submitted to OSHPD for review and approval.*
11. *For in-plane collectors transferring axial loads into the sideplate connection, coordination between sideplate and the registered design professional in responsible charge will be required to confirm the collector connection is sufficient to transfer the load into the moment frame system. This requirement shall be satisfied by designing the sideplate connections in the first bay of a multi-bay sideplate moment frame or an end bay to have a minimum connection capacity, including combined shear ($V_u + V_g$) and moment (M_{pr}) demands, of at least 1.2 times the M_{pr} at the plastic hinge location when the axial load, as determined by ASCE 7, Section 12.10.2.1 without Ω_o, exceeds 0.1 F_yA_g of the sideplate beam.*
12. *A complete frame analysis for gravity and design wind loading using LRFD load combinations in Section 1605.1 shall be performed including Demand/Capacity Ratios. Frame beam member nominal moment strengths (M_n) used for gravity and design wind loading for the bolted sideplate connection using Class A or Class B faying surfaces shall be taken as $0.80F_yZ$ for frame beams up to 300 plf and $0.60F_yZ$ for frame beams greater than 300 plf.*
13. *For moment frame beams with maximum beam shear greater than 90 percent of the vertical bolt shear capacity, a secondary check is to be provided to confirm the vertical bolt shear capacities are sufficient.*

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14. *Bolted sideplate connections used on heavy-shallow frame beams for beams greater than 200 plf and shallower than 24 inches (610 mm) in depth shall be considered as an alternative system.*
15. *Skewed beams shall utilize the link-beam fabrication method with CJP welded splices for skew angles. The skew angle shall be less than 15 degrees.*
16. *For two-sided bolted sideplate connections sharing the same side plates at the same height and depth across the column, the vertical offset in the beams shall not exceed 10 inches (254 mm).*

2202.4.4 Modifications to AISC 358 Chapter 12. *The Simpson Strong-Tie (SST) Strong Frame bolted moment connection shall be permitted, provided:*

1. *Only T-stub yield links are permitted. End plate yield links are not permitted.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *Beam flange width-to-thickness ratio shall satisfy AISC 341 Table D1.1b.*
4. *Yield-Link stem-to-beam flange connection bolts shall not slip under wind design demand loads. Yield-Link stem-to-beam flange connection shall be designed to prevent slip using AISC 360 Equation J3-4, where the slip resistance, μ, is taken to be 0.3.*
5. *Double shear plate connection is permitted to increase connection axial capacity for collector loads. A partial joint penetration (PJP) groove weld for second shear plate is permissible due to space restrictions.*

2202.4.5 Modifications to AISC 358 Chapter 15. *The DuraFuse Frames (DFF) bolted moment connection shall be permitted, provided:*

1. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
2. *DFF connection bolts shall not slip under wind design demand loads. The connection shall be designed to prevent slip using AISC 360 Equation J3-4, where the slip resistance is taken to be 0.3.*
3. *Beam flange width-to-thickness ratio shall satisfy AISC 341 Table D1.1b.*
4. *The beam weight shall be limited to a maximum of 232 pounds per foot (345 kg/m).*

SECTION 2203—STRUCTURAL STAINLESS STEEL

2203.1 General. The design, fabrication and erection of austenitic and duplex structural stainless steel shall be in accordance with AISC 370.

SECTION 2204—COLD-FORMED STEEL

2204.1 General. The design of cold-formed carbon and low-alloy steel structural members not covered in Sections 2206 through 2209 shall be in accordance with AISI S100. The design of cold-formed steel diaphragms shall be in accordance with additional provisions of AISI S310 as applicable. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2204.2.

2204.2 Seismic design. The design and detailing of cold-formed steel seismic force-resisting systems shall be in accordance with Sections 2204.2.1 and 2204.2.2, as applicable.

[OSHPD 1R, 2 & 5] *Cold-formed steel structures shall be designed and detailed in accordance with the requirements of AISI S100 and AISI S400. Cold-formed steel special bolted moment frames are not permitted by OSHPD.*

2204.2.1 CFS special bolted moment frames. Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1, is used for the design of cold-formed steel special bolted moment frames, the structures shall be designed and detailed in accordance with the requirements of AISI S400.

2204.2.2 Cold-formed steel seismic force-resisting systems. The response modification coefficient, *R*, designated in ASCE 7 Table 12.2-1 for “Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" shall be permitted for systems designed and detailed in accordance with AISI S100. Such systems need not be designed and detailed in accordance with AISI S400.

SECTION 2205—COLD-FORMED STAINLESS STEEL

2205.1 General. The design of cold-formed stainless steel structural members shall be in accordance with ASCE 8.

[OSHPD 1R, 2 & 5] *Modify AISI S100 Chapter J (Connections and Joints, Section J7.2) by the following: Power-actuated fastener allowable design strength shall not exceed that permitted in the evaluation report qualified by ICC AC 70 or ASCE 7, Section 13.4.5.*

SECTION 2206—COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2206.1 Structural framing. For cold-formed steel light-frame construction, the design and installation of the following structural framing systems, including their members and connections, shall be in accordance with AISI S240, and Sections 2206.1.1 through 2206.1.3, as applicable:

1. Floor and roof systems.

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2. Structural walls.
3. Shear walls, strap-braced walls and diaphragms that resist in-plane lateral loads.
4. Trusses.

2206.1.1 Seismic requirements for cold-formed steel structural systems. The design of cold-formed steel light-frame construction to resist seismic forces shall be in accordance with the provisions of Section 2206.1.1.1 or 2206.1.1.2, as applicable.

2206.1.1.1 Seismic Design Categories B and C. Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1 is used for the design of cold-formed steel light-frame construction assigned to Seismic Design Category B or C, the seismic force-resisting system shall be designed and detailed in accordance with the requirements of AISI S400.

Exception: The response modification coefficient, *R*, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISI S240 and need not be designed and detailed in accordance with AISI S400.

2206.1.1.2 Seismic Design Categories D through F. In cold-formed steel light-frame construction assigned to Seismic Design Category D, E or F, the seismic force-resisting system shall be designed and detailed in accordance with AISI S400.

[OSHPD 1R, 2 & 5]:

1. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*
2. *Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI S400 are not permitted within the seismic force-resisting system of buildings.*

2206.1.2 Prescriptive framing. Detached one- and two-family dwellings and townhouses, less than or equal to three stories above grade plane, shall be permitted to be constructed in accordance with AISI S230 subject to the limitations therein.

2206.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections 2206.1.3.1. through 2206.1.3.3.

*[**OSHPD 1R, 2 & 5]** Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required, the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.*

2206.1.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section I1 of AISI S202 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing.

2206.1.3.2 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705.2.

2206.1.3.3 Truss quality assurance. Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency in accordance with AISI S240 Chapter D shall be fabricated in compliance with Sections 1704.2.5 and 1705.2, as applicable.

2206.2 Nonstructural members. For cold-formed steel light-frame construction, the design and installation of nonstructural members and connections shall be in accordance with AISI S220.

***[OSHPD 1R, 2 & 5]** for noncomposite assembly design. Where nonstructural members do not qualify for design under AISI S220, the design and installation of nonstructural members and connections shall be in accordance with AISI S240 or S100.*

2206.3 Cutting and notching. The cutting and notching of holes in cold-formed steel framing members shall be in accordance with AISI S240 for structural members and AISI S220 for nonstructural members.

SECTION 2207—STEEL JOISTS

2207.1 General. The design, manufacture and use of open-web steel joists and joist girders shall be in accordance with either SJI 100 or SJI 200, as applicable.

2207.1.1 Seismic design. Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2202.2 or 2206.1.1.

2207.2 Design. The registered design professional shall indicate on the construction documents the steel joist and steel joist girder designations from SJI 100 or SJI 200; and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, bridging design that differs from SJI 100 or SJI 200, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
    1.1. Concentrated loads.
    1.2. Nonuniform loads.
    1.3. Net uplift loads.
    1.4. Axial loads.

1.5. End moments.
1.6. Connection forces.

2. Special considerations including:
   2.1. Profiles for joist and joist girder configurations that differ from those defined by SJI 100 or SJI 200.
   2.2. Oversized or other nonstandard web openings.
   2.3. Extended ends.
3. Deflection criteria for joists and joist girder configurations that differ from those defined by SJI 100 or SJI 200.

2207.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and steel joist girders in accordance with SJI 100 or SJI 200 to support the load requirements of Section 2207.2. The registered design professional shall be permitted to require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. Where requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to the design calculations submitted under seal and signature, the following shall be included:

1. Bridging design that differs from SJI 100 or SJI 200, such as cantilevered conditions and net uplift.
2. Connection design for:
   2.1. Connections that differ from SJI 100 or SJI 200, such as flush-framed or framed connections.
   2.2. Field splices.
   2.3. Joist headers.

2207.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the approved construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207.2. Steel joist placement plans shall include, at a minimum, the following:

1. Listing of applicable loads as stated in Section 2207.2 and used in the design of the steel joists and joist girders as specified in the approved construction documents.
2. Profiles for joist and joist girder configurations that differ from those defined by SJI 100 or SJI 200.
3. Connection requirements for:
   3.1. Joist supports.
   3.2. Joist girder supports.
   3.3. Field splices.
   3.4. Bridging attachments.
4. Deflection criteria for joists and joist girder configurations that differ from those defined by SJI 100 or SJI 200.
5. Size, location and connections for bridging.
6. Joist headers.

Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional. ***[OSHPD 1R, 2 & 5]*** *Not permitted by OSHPD.*

2207.5 Certification. At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704.5 stating that work was performed in accordance with approved construction documents and with SJI 100 or SJI 200, as applicable.

2207.6 Joist chord bracing. [OSHPD 1R, 2 & 5] *The chords of all joists shall be laterally supported at all points where the chords change direction.*

SECTION 2208—STEEL DECK

2208.1 Steel decks. The design and construction of cold-formed steel floor and roof decks and composite slabs of concrete and steel deck shall be in accordance with SDI SD. The design of cold-formed steel diaphragms shall be in accordance with additional provisions of AISI S310, as applicable.

[OSHPD 1R, 2 & 5] *The base material thickness of the steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

Exception: *For single-story, nonbuilding structures similar to buildings, the minimum deck thickness need not apply if the steel roof deck is not being used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

SECTION 2209—STEEL STORAGE RACKS

2209.1 General. The design, testing and utilization of steel storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with ANSI MH16.1. The design, testing and utilization of steel cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with ANSI MH 16.3.

2209.2 Seismic design. Where required by ASCE 7, the seismic design of steel storage racks and cantilevered steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

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2209.3 Certification. For steel storage racks that are 8 feet (2438 mm) in height or greater to the top load level and assigned to Seismic Design Category D, E, or F at completion of the storage rack installation, a certificate of compliance shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents.

SECTION 2210—METAL BUILDING SYSTEMS

2210.1 General. The design, fabrication and erection of a metal building system shall be in accordance with the provisions of this section.

2210.1.1 Design. The design of metal building systems shall be in accordance with Sections 2210.1.1.1 through 2210.1.1.4, as applicable.

2210.1.1.1 Structural steel. The design, fabrication and erection of structural steel shall be in accordance with Section 2202.

2210.1.1.2 Cold-formed steel. The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with Section 2204.

2210.1.1.3 Steel joists. The design of steel joists shall be in accordance with Section 2207.

2210.1.1.4 Steel cable. The design, fabrication and erection of steel cables, including related connections, shall be in accordance with Section 2214.

2210.2 Seismic design. Where required, the seismic design, fabrication and erection of the structural steel seismic force-resisting system shall be in accordance with Section 2202.2.1 or 2202.2.2, as applicable.

SECTION 2211—INDUSTRIAL BOLTLESS STEEL SHELVING

2211.1 General. The design, testing and utilization of industrial boltless steel shelving shall be in accordance with MHI ANSI/MH 28.2. Where required by ASCE 7, the seismic design of industrial boltless steel shelving shall be in accordance with Chapter 15 of ASCE 7.

SECTION 2212—INDUSTRIAL STEEL WORK PLATFORMS

2212.1 General. The design, testing and utilization of industrial steel work platforms shall be in accordance with MHI ANSI/MH 28.3. Where required by ASCE 7, the seismic design of industrial steel work platforms shall be in accordance with Chapter 15 of ASCE 7.

SECTION 2213—STAIRS, LADDERS AND GUARDING FOR STEEL STORAGE RACKS AND INDUSTRIAL STEEL WORK PLATFORMS

2213.1 General. The design and installation of stairs, ladders and guarding serving steel storage racks and industrial steel work platforms used in material handling structures shall be in accordance with MHI ANSI/MH 32.1.

SECTION 2214—STEEL CABLE STRUCTURES

2214.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

[OSHPD 1R, 2 & 5] *Steel cables with glass or polymer fabric material acting as a tensile membrane structure shall be considered as an alternative system.*

SECTION 2215—ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

2215.1 General.

2215.1.1 Shear transfer at column base plate. *Where the holes in column base plates are more than $^1/_8$ inch (3 mm) larger than the anchor rods, as permitted by AISC 360, the anchor rods shall be designed for the induced bending stresses in combination with axial and shear stresses. Alternatively, shear lugs designed in accordance with ACI 318 Section 17.11 shall be permitted to transfer shear forces between column base plates and the supporting structure.*

2215.2 Modifications to AISC 341.

2215.2.1 Section B5. *Modify exception of Section B5.2 as follows:*

Exception: The forces specified in this section need not be applied to truss diaphragms designed as a part of a three-dimensional system in which the seismic force-resisting system types consist of ordinary moment frames, ordinary concentrically braced frames, ordinary cantilever column systems, special cantilever column systems, or combinations thereof, and where *each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance and where* the truss diagonal members conform to Sections F1.4b and F1.5 and the connections conform to Section F1.6.

2215.2.2 Section D2. *Modify Section D2.6c(b)(2) as follows:*

(2) The moment calculated using the *load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.*

2215.3 Seismic requirements for composite structural steel and concrete construction. *In addition to the requirements of Section 2202.2.1, steel and concrete ConXtech ConXL composite special moment frame with the approved moment connections in accordance with AISC 358 Chapter 10 shall be permitted provided:*

1. *Beams are provided with reduced beam sections (RBS);*

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2. *Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $^{1}/_{4}$-inch fillet weld; and*
3. *The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $^{1}/_{2}$ inch.*

2215.4 Steel joists.

2215.4.1 Design approval. *Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with Title 24, Part 1. Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.*

2215.4.2 Joist chord bracing. *The chords of all joists shall be laterally supported at all points where the chords change direction.*

2215.5 Cold-formed steel light-frame construction.

2215.5.1 Trusses.

2215.5.1.1 Analysis submittals. *Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.*

2215.5.1.2 Deferred submittals. *Deferred submittal per Section I1.4.2 of AISI 202 is not permitted by DSA-SS/CC.*

2215.5.2 Anchorage for shear. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*

2215.5.3 Limitations on shear wall assemblies. *Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI-S400 are not permitted within the seismic force-resisting system of buildings or structures assigned to Risk Category II, III, IV or buildings designed to be relocatable.*

2215.6 Testing.

2215.6.1 Tests of high-strength bolts, nuts and washers. *High-strength bolts, nuts and washers shall be sampled and tested in accordance with Section 1705A.2.8.*

2215.6.2 Tests of end-welded studs. *End-welded studs shall be sampled and tested in accordance with the requirements of the AWS D1.1.*

SECTION 2216—TESTING AND FIELD VERIFICATION [OSHPD 1R, 2 & 5]

2216.1 Tests of high-strength bolts, nuts and washers*. High-strength bolts, nuts and washers shall be sampled and tested by an approved agency for conformance with the requirements of applicable ASTM standards.*

A minimum of nine samples per lot, as defined in the ASTM standards for bolts [not nuts and washers], shall be tested for tensile properties in accordance with ASTM F606, but need not exceed three samples per 400 bolts.

2216.2 Tests of end-welded studs. *End-welded studs shall be tested in accordance with the requirements of the AWS D1.1, Clauses 9.7 and 9.8.*

Exception: *Fillet-welded studs exempted by AWS D1.1, Clause 9.5*

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 22A – STEEL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter								X		X				X										
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

22A STEEL

User notes:

About this chapter: *Chapter 22A provides the requirements necessary for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures, and steel storage racks. Chapter 22A is applicable to structures regulated by the Division of the State Architect-Structural Safety—including public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings (applications listed in Sections 1.9.2.1 [DSA-SS] and 1.9.2.2 [DSA-SS/CC])—and by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development—including hospitals and correctional treatment centers (applications listed in Sections 1.10.1 [OSHPD 1] and 1.10.4 [OSHPD 4]).*

This chapter was extensively reorganized for the 2024 edition. For complete information, see the relocations table in the Preface information of this code.

SECTION 2201A—GENERAL

2201A.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

2201A.1.1 Application. *The scope of application of Chapter 22A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Structures regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1 and 1.10.4. These applications include hospitals and correctional treatment centers.*

2201A.1.2 Amendments in this chapter. *DSA-SS and OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:* ***[DSA-SS]*** *For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Hospital Planning and Development:*

   [OSHPD 1] - *For applications listed in Section 1.10.1.*

   [OSHPD 4] - *For applications listed in Section 1.10.4.*

2201A.2 Identification. Identification of steel members shall be in accordance with the applicable referenced standards within this chapter. Other steel furnished for structural load-carrying purposes shall be identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards. ***[DSA-SS]*** *All material identification and testing shall be in accordance with Chapter 17A.*

2201A.3 Protection. The protection of steel members shall be in accordance with the applicable referenced standards within this chapter.

2201A.4 Connections. The design and installation of steel connections shall be in accordance with the applicable referenced standards within this chapter. For special inspection of welding or installation of high-strength bolts, see Section 1705A.2.

2201A.4.1 Restrained welded connections. [OSHPD 1 & 4] *Welded structural steel connections having a medium or high level of restraint, as defined by AWS D1.1 Annex H, shall have a minimum pre-heat temperature of not less than 150°F (66°C). Welded structural steel connections with welds to flange, web, wall or plate having a high level of restraint shall maintain a post-heat temperature of 300°F (149°C) for a minimum of 1 hour after completion of welding.*

2201A.5 Anchor rods. Anchor rods shall be set in accordance with the approved construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts, but shall not be greater than the length of the threaded portion of the bolts.

2201A.5.1 Shear transfer at column base plate. *Where the holes in column base plates are more than $^{1}/_{8}$ inch (3 mm) larger than the anchor rods, as permitted by AISC 360, the anchor rods shall be designed for the induced bending stresses in combination with axial and shear stresses. Alternatively, shear lugs designed in accordance with ACI 318 Section 17.11 shall be permitted to transfer shear forces between column base plates and the supporting structure.*

SECTION 2202A—STRUCTURAL STEEL AND COMPOSITE STRUCTURAL STEEL AND CONCRETE

2202A.1 General. The design, fabrication and erection of structural steel elements and composite structural steel and concrete elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

Exceptions*: [OSHPD 1 & 4]*

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1. *For members designed based on tension, the slenderness ratio (L/r) shall not exceed 300, except for the design of hangers and bracing in accordance with NFPA 13 and for rod hangers in tension.*
2. *For members designed based on compression, the slenderness ratio (KL/r) shall not exceed 200, except for the design of hangers and bracing in accordance with NFPA 13.*

2202*A*.2 Seismic design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section 2202*A*.2.1 or 2202*A*.2.2, as applicable.

2202*A*.2.1 Structural steel seismic force-resisting systems and composite structural steel and concrete seismic force-resisting systems. The design, detailing, fabrication and erection of structural steel seismic force-resisting systems and composite structural steel and concrete seismic force-resisting systems shall be in accordance with the provisions of Section 2202*A*.2.1.1 or 2202*A*.2.1.2, as applicable. *Seismic force-resisting systems of structural steel acting compositely with reinforced concrete shall be considered as an alternative system, except as permitted by:*

[DSA-SS] *Section 2202A.6.1.*

[OSHPD 1 & 4] *Section 2202A.4.1.*

2202*A*.2.1.1 Seismic Design Category B or C. *Not permitted by DSA-SS and OSHPD.*

2202*A*.2.1.2 Seismic Design Category D, E or F. Structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341. Beam-to-column moment connections in structural steel special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358.

2202*A*.2.2 Structural steel elements. The design, detailing, fabrication and erection of structural steel elements in seismic force-resisting systems, including struts, collectors, chords and foundation elements, shall be in accordance with AISC 341.

2202A.3 Modifications to AISC 341. [OSHPD 1 and 4]

2202A.3.1 Section A4. *Modify Section A4.1 Item (c) by adding the following:*

(c) Locations and dimensions of protected zones. The fabricator shall permanently mark protected zones of structural elements in the seismic force-resisting system in the building that are designated on the construction documents. If these markings are obscured during construction, such as after the application of fire protection, the owner's designated representative shall re-mark the protected zones as they are designated on the construction documents. [OSHPD 1 & 4] Primers or paints used to mark protected zones on steel surfaces, which are to receive sprayed fire-resistance material, shall comply with California Building Code Section 704.13.3.2.

2202A.3.2 Section I2. [OSHPD 1 & 4] *Replace Section I2.1 Item (d) as follows:*

(d) Decking attachments that penetrate the beam flange shall not be placed on beam flanges within the protected zone, except power-actuated fasteners up to 0.18 inch in diameter are permitted, provided that the penetration is less than 85 percent of beam flange thickness.

2202A.4 Modifications to AISC 358. [OSHPD 1 and 4]

2202A.4.1 Modifications to AISC 358 Chapter 10. [OSHPD 1 and 4] *Steel and concrete ConXtech ConXL composite special moment frame connections shall be permitted, provided:*

1. *Beams are provided with reduced beam sections (RBS);*
2. *Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $^{1}/_{4}$ inch fillet weld; and*
3. *The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $^{1}/_{2}$ inch.*

2202A.4.2 Modifications to AISC 358 Chapter 11 Welded Moment Connection. *The welded side plate steel moment connection shall be permitted, provided:*

1. *The beams shall consist of either rolled or built-up wide flange sections.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *For SMF and IMF systems, U-shaped cover plates shall be used and the hinge-to-hinge span to beam depth, L_h/d, shall be greater than or equal to 5.*
4. *The width-to-thickness ratios for beam flanges shall not be less than 3.*
5. *The spacing for lateral bracing of wide flange beams, L_b, shall include the length of the side plate at beam ends.*
6. *The extension of the side plates beyond the face of the column shall be within the range of 0.77d to 1.0d.*
7. *The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.*

   Exception: *The gap-to-side plate thickness ratio shall be permitted to be modified for moment connections with unequal beam sizes on opposite sides of the column or when orthogonal beams acting as drag connections frame into the side plate.*
8. *Demand critical fillet welds {2}, {5}, {5a} and {7} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches on either side of the start/stop location.*

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2202A.4.3 Modifications to AISC 358 Chapter 11 Bolted Moment Connection. *The bolted sideplate steel moment connection shall be permitted, provided:*

1. *The beams shall consist of either rolled or built-up wide flange sections. Columns shall consist of rolled or built-up wide flange sections or noncomposite built-up box or HSS with a minimum wall thickness of $^3/_4$ inch (19 mm), or satisfy the requirements of width-to-thickness ratios of highly ductile members in AISC 341.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *For SMF and IMF systems, on the sideplate standard or configuration A the U-shaped cover plates shall be used with the k dimension extension. The k dimension extension length is defined as beam depth d_b/6, rounded to the nearest $^1/_2$ inch (12.7 mm).*
4. *The hinge-to-hinge span to beam depth, L_H/d, shall be greater than or equal to 4.5.*
5. *The width-to-thickness ratios for beam flanges shall not be less than 3.5.*

   Exception: *For width-to-thickness ratios less than 3.5 the C_{pr} shall be calculated in accordance with that for welded sideplate connections but in no case shall the width-to-thickness ratio be less than 3.0.*
6. *The minimum bolt-to-bolt spacing shall not be less than 3 bolt diameters.*
7. *The extension of the side plates beyond the face of the column shall be within the range of 0.65d to 1.5d.*
8. *The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.*

   Exception: *The gap-to-side plate thickness ratio shall be permitted to be modified for moment connections with unequal beam sizes on opposite sides of the column or when orthogonal beams acting as drag connections frame into the side plate.*
9. *Demand Critical fillet welds {2}, {5}, {5a} and {8} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch (152 mm) length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches (152 mm) on either side of the start/stop location.*
10. *The connection specific factor to account for peak connection strength, C_{pr}, shall be between 1.15 and 1.35. Calculations shall be submitted to OSHPD for review and approval.*
11. *For in-plane collectors transferring axial loads into the sideplate connection, coordination between sideplate and the registered design professional in responsible charge will be required to confirm the collector connection is sufficient to transfer the load into the moment frame system. This requirement shall be satisfied by designing the sideplate connections in the first bay of a multi-bay sideplate moment frame or an end bay to have a minimum connection capacity, including combined shear ($V_u + V_g$) and moment (M_{pr}) demands, of at least 1.2 times the M_{pr} at the plastic hinge location when the axial load, as determined by ASCE 7, Section 12.10.2.1 without Ω_o, exceeds 0.1 F_yA_g of the sideplate beam.*
12. *A complete frame analysis for gravity and design wind loading using LRFD load combinations in Section 1605A.1 shall be performed including Demand/Capacity Ratios. Frame beam member nominal moment strengths (M_n) used for gravity and design wind loading for the bolted sideplate connection using Class A or Class B faying surfaces shall be taken as 0.80 F_yZ for frame beams up to 300 plf and 0.60 F_yZ for frame beams greater than 300 plf.*
13. *For moment frame beams with maximum beam shear greater than 90 percent of the vertical bolt shear capacity, a secondary check is to be provided to confirm the vertical bolt shear capacities are sufficient.*
14. *Bolted sideplate connections used on heavy-shallow frame beams for beams greater than 200 plf and shallower than 24 inches (610 mm) in depth shall be considered as an alternative system.*
15. *Skewed beams shall utilize the link-beam fabrication method with CJP welded splices for skew angles. The skew angle shall be less than 15 degrees.*
16. *For two-sided bolted sideplate connections sharing the same side plates at the same height and depth across the column, the vertical offset in the beams shall not exceed 10 inches (254 mm).*

2202A.4.4 Modifications to AISC 358 Chapter 12. *The Simpson Strong-Tie (SST) Strong Frame bolted moment connection shall be permitted, provided:*

1. *Only T-stub yield links are permitted. End plate yield links are not permitted.*
2. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*
3. *Beam flange width-to-thickness ratio shall satisfy AISC 341 Table D1.1b.*
4. *Yield-Link stem-to-beam flange connection bolts shall not slip under wind design demand loads. Yield-Link stem to beam flange connection shall be designed to prevent slip using AISC 360 Equation J3-4, where the slip resistance, μ, is taken to be 0.3.*
5. *Double shear plate connection is permitted to increase connection axial capacity for collector loads. A partial joint penetration (PJP) groove weld for second shear plate is permissible due to space restrictions.*

2202A.4.5 Modifications to AISC 358 Chapter 15. *The DuraFuse Frames (DFF) bolted moment connection shall be permitted, provided:*

1. *The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.*

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2. *DFF connection bolts shall not slip under wind design demand loads. The connection shall be designed to prevent slip using AISC 360 Equation J3-4, where the slip resistance is taken to be 0.3.*
3. *Beam flange width-to-thickness ratio shall satisfy AISC 341 Table D1.1b.*
4. *The beam weight shall be limited to a maximum of 232 pounds per foot (345 kg/m).*

2202A.5 Modifications to AISC 341. [DSA-SS]

2202A.5.1 Section B5. *Modify exception of Section B5.2 as follows:*

Exception: The forces specified in this section need not be applied to truss diaphragms designed as a part of a three-dimensional system in which the seismic force-resisting system types consist of ordinary moment frames, ordinary concentrically braced frames, ordinary cantilever column systems, special cantilever column systems, or combinations thereof, and where *each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance and where* the truss diagonal members conform to Sections F1.4b and F1.5 and the connections conform to Section F1.6.

2202A.5.2 Section D2. *Modify Section D2.6c(b)(2) as follows:*

(2) The moment calculated using the *load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.*

2202A.6 Modifications to AISC 358. [DSA-SS]

2202A.6.1 Modifications to AISC 358 Chapter 10. [DSA-SS] *Steel and concrete ConXtech ConXL composite special moment frame connections shall be permitted, provided:*

1. *Beams are provided with reduced beam sections (RBS);*
2. *Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $^{1}/_{4}$ inch fillet weld; and*
3. *The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $^{1}/_{2}$ inch.*

SECTION 2203*A*—STRUCTURAL STAINLESS STEEL

2203*A*.1 General. The design, fabrication and erection of austenitic and duplex structural stainless steel shall be in accordance with AISC 370.

SECTION 2204*A*—COLD-FORMED STEEL

2204*A*.1 General. The design of cold-formed carbon and low-alloy steel structural members not covered in Sections 2206*A* through 2209*A* shall be in accordance with AISI S100. The design of cold-formed steel diaphragms shall be in accordance with additional provisions of AISI S310 as applicable.

SECTION 2205*A*—COLD-FORMED STAINLESS STEEL

2205*A*.1 General. The design of cold-formed stainless steel structural members shall be in accordance with ASCE 8.

SECTION 2206*A*—COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2206*A*.1 Structural framing. For cold-formed steel light-frame construction, the design and installation of the following structural framing systems, including their members and connections, shall be in accordance with AISI S240, and Sections 2206*A*.1.1 through 2206*A*.1.3, as applicable:

1. Floor and roof systems.
2. Structural walls.
3. Shear walls, strap-braced walls and diaphragms that resist in-plane lateral loads.
4. Trusses.

2206*A*.1.1 Seismic requirements for cold-formed steel structural systems. The design of cold-formed steel light-frame construction to resist seismic forces shall be in accordance with the provisions of Section 2206*A*.1.1.1 or 2206*A*.1.1.2, as applicable.

2206*A*.1.1.1 Seismic Design Categories B and C. *Not permitted by DSA-SS and OSHPD.*

2206*A*.1.1.2 Seismic Design Categories D through F. In cold-formed steel light-frame construction assigned to Seismic Design Category D, E or F, the seismic force-resisting system shall be designed and detailed in accordance with AISI S400. *The following additional requirements apply:*

1. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*
2. *Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI 400 are not permitted within the seismic force-resisting system of buildings.*

2206*A*.1.2 Prescriptive framing. *Not permitted by DSA-SS and OSHPD.*

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2206*A*.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections 2206*A*.1.3.1. through 2206*A*.1.3.3.

Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required, the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.

2206*A*.1.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section I1 of AISI S202 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing. ***[DSA-SS]*** *Deferred submittal per Section I1.4.2 of AISI S202 is not permitted by DSA-SS.*

2206*A*.1.3.2 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705.2.

2206*A*.1.3.3 Truss quality assurance. Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency in accordance with AISI S240 Chapter D shall be fabricated in compliance with Sections 1704.2.5 and 1705.2, as applicable.

2206*A*.2 Nonstructural members. For cold-formed steel light-frame construction, the design and installation of nonstructural members and connections shall be in accordance with AISI S220 *for noncomposite assembly design. Where nonstructural members do not qualify for design under AISI S220, the design and installation of nonstructural members and connections shall be in accordance with AISI S240 or S100.*

2206*A*.3 Cutting and notching. The cutting and notching of holes in cold-formed steel framing members shall be in accordance with AISI S240 for structural members and AISI S220 for nonstructural members.

SECTION 2207*A*—STEEL JOISTS

2207*A*.1 General. The design, manufacture and use of open-web steel joists and joist girders shall be in accordance with either SJI 100 or SJI 200, as applicable.

2207*A*.1.1 Seismic design. Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2202*A*.2 or 2206*A*.1.1.

2207*A*.2 Design. The registered design professional shall indicate on the construction documents the steel joist and steel joist girder designations from SJI 100 or SJI 200; and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, bridging design that differs from SJI 100 or SJI 200, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
    - 1.1. Concentrated loads.
    - 1.2. Nonuniform loads.
    - 1.3. Net uplift loads.
    - 1.4. Axial loads.
    - 1.5. End moments.
    - 1.6. Connection forces.
2. Special considerations including:
    - 2.1. Profiles for joist and joist girder configurations that differ from those defined by SJI 100 or SJI 200.
    - 2.2. Oversized or other nonstandard web openings.
    - 2.3. Extended ends.
3. Deflection criteria for joists and joist girder configurations that differ from those defined by SJI 100 or SJI 200.

2207*A*.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and steel joist girders in accordance with SJI 100 or SJI 200 to support the load requirements of Section 2207*A*.2. The registered design professional shall be permitted to require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. Where requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to the design calculations submitted under seal and signature, the following shall be included:

1. Bridging design that differs from SJI 100 or SJI 200, such as cantilevered conditions and net uplift.
2. Connection design for:
    - 2.1. Connections that differ from SJI 100 or SJI 200, such as flush-framed or framed connections.
    - 2.2. Field splices.
    - 2.3. Joist headers.

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2207*A*.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the approved construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207*A*.2. Steel joist placement plans shall include, at a minimum, the following:

1. Listing of applicable loads as stated in Section 2207*A*.2 and used in the design of the steel joists and joist girders as specified in the approved construction documents.
2. Profiles for joist and joist girder configurations that differ from those defined by SJI 100 or SJI 200.
3. Connection requirements for:
   - 3.1. Joist supports.
   - 3.2. Joist girder supports.
   - 3.3. Field splices.
   - 3.4. Bridging attachments.
4. Deflection criteria for joists and joist girder configurations that differ from those defined by SJI 100 or SJI 200.
5. Size, location and connections for bridging.
6. Joist headers.

2207A.4.1 Design approval. [DSA-SS] *Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.*

2207*A*.5 Certification. At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704.5 stating that work was performed in accordance with approved construction documents and with SJI 100 or SJI 200, as applicable.

2207A.6 Joist chord bracing. *The chords of all joists shall be laterally supported at all points where the chords change direction.*

SECTION 2208*A*—STEEL DECK

2208*A*.1 Steel decks. The design and construction of cold-formed steel floor and roof decks and composite slabs of concrete and steel deck shall be in accordance with SDI SD. The design of cold-formed steel diaphragms shall be in accordance with additional provisions of AISI S310, as applicable. *The base material thickness of steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

Exception: [DSA-SS] *For single-story open structures, the minimum deck thickness may be waived if the steel roof deck need not be used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

SECTION 2209*A*—STEEL STORAGE RACKS

2209*A*.1 General. The design, testing and utilization of steel storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with ANSI MH16.1. The design, testing and utilization of steel cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with ANSI MH 16.3.

2209*A*.2 Seismic design. Where required by ASCE 7, the seismic design of steel storage racks and cantilevered steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209*A*.3 Certification. For steel storage racks that are 8 feet (2438 mm) in height or greater to the top load level and assigned to Seismic Design Category D, E, or F at completion of the storage rack installation, a certificate of compliance shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents.

SECTION 2210*A*—METAL BUILDING SYSTEMS

2210*A*.1 General. The design, fabrication and erection of a metal building system shall be in accordance with the provisions of this section.

2210*A*.1.1 Design. The design of metal building systems shall be in accordance with Sections 2210*A*.1.1.1 through 2210*A*.1.1.4, as applicable.

2210*A*.1.1.1 Structural steel. The design, fabrication and erection of structural steel shall be in accordance with Section 2202*A*.

2210*A*.1.1.2 Cold-formed steel. The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with Section 2204*A*.

2210*A*.1.1.3 Steel joists. The design of steel joists shall be in accordance with Section 2207*A*.

2210*A*.1.1.4 Steel cable. The design, fabrication and erection of steel cables, including related connections, shall be in accordance with Section 2214*A*.

2210*A*.2 Seismic design. Where required, the seismic design, fabrication and erection of the structural steel seismic force-resisting system shall be in accordance with Section 2202*A*.2.1 or 2202*A*.2.2, as applicable.

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SECTION 2211*A*—INDUSTRIAL BOLTLESS STEEL SHELVING

2211*A*.1 General. The design, testing and utilization of industrial boltless steel shelving shall be in accordance with MHI ANSI/MH 28.2. Where required by ASCE 7, the seismic design of industrial boltless steel shelving shall be in accordance with Chapter 15 of ASCE 7.

SECTION 2212*A*—INDUSTRIAL STEEL WORK PLATFORMS

2212*A*.1 General. The design, testing and utilization of industrial steel work platforms shall be in accordance with MHI ANSI/MH 28.3. Where required by ASCE 7, the seismic design of industrial steel work platforms shall be in accordance with Chapter 15 of ASCE 7.

SECTION 2213*A*—STAIRS, LADDERS AND GUARDING FOR STEEL STORAGE RACKS AND INDUSTRIAL STEEL WORK PLATFORMS

2213*A*.1 General. The design and installation of stairs, ladders and guarding serving steel storage racks and industrial steel work platforms used in material handling structures shall be in accordance with MHI ANSI/MH 32.1.

SECTION 2214*A*—STEEL CABLE STRUCTURES

2214*A*.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19. *Steel cables with glass or polymer fabric material acting as a tensile membrane structure is an alternative system.*

SECTION 2215A—[DSA-SS] LIGHT MODULAR STEEL MOMENT FRAMES FOR PUBLIC ELEMENTARY AND SECONDARY SCHOOLS, AND COMMUNITY COLLEGES

2215A.1 General.

2215A.1.1 Configuration. *Light modular steel moment frame buildings shall be constructed of factory-assembled modules comprising a single-story moment-resisting space frame supporting a floor and roof. Individual modules shall not exceed a width of 14 feet (4.25 m) nor a length of 72 feet (22 m). All connections of beams to corner columns shall be designed as moment-resisting in accordance with the criteria of Section 2215A.2. Modules may be stacked to form multistory structures not exceeding 35 feet or two stories in height. When stacked modules are evaluated separately, seismic forces on each module shall be distributed in accordance with Section 12.8.3 of ASCE 7, considering the modules in the stacked condition. See Section 2215A.2.5 of this code.*

2215A.1.2 Design, fabrication and erection. *The design, fabrication and erection of light modular steel moment- frame buildings shall be in accordance with the AISC Specification for Structural Steel Buildings (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold-Formed Steel Structural Members (AISI S100), as applicable, and the requirements of this section. The maximum dead load of the roof and elevated floor shall not exceed 25 psf and 50 psf (1197 Pa and 2394 Pa), respectively. The maximum dead load of the exterior walls shall not exceed 45 psf (2155 Pa).*

2215A.2 Seismic requirements. *In addition to the other requirements of this code, the design, materials and workmanship of light modular steel moment frames shall comply with the requirements of this section. The response modification coefficient R shall be equal to $3^1/_2$. C_d and Ω_0 shall be equal to 3.0.*

2215A.2.1 Base materials. *Beams, columns and connection materials shall be limited to those materials permitted under the AISC Specification for Structural Members (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold-Formed Steel Structural Members (AISI S100). All columns shall conform with standard AISC 360 shapes.*

2215A.2.2 Beam-to-column strength ratio. *At each moment-resisting connection the following shall apply:*

$$\frac{\sum S_{bi}F_{ybi}}{\sum S_{cj}F_{ycj}} \geq 1.4 \quad \textbf{(Equation 22A-1)}$$

where:

F_{ybi} = *The specified yield stress of beam "i."*

F_{ycj} = *The specified yield stress of column "j."*

S_{bi} = *The flexural section modulus of each beam "i" that is moment connected to the column "j" at the connection.*

S_{cj} = *The flexural section modulus of each column "j" that is moment connected to the beam "i" at the connection.*

Exceptions:

1. *Beam-to-column connections at the floor level beams of first or second-story modules need not comply with this requirement.*
2. *Beam-to-column strength ratios less than 1.4 are allowed if proven to be acceptable by analysis or testing.*

2215A.2.3 Welding. *Weld filler metals shall be capable of producing weld metal with a minimum Charpy V-Notch toughness of 20 ft-lb at 0°F. Where beam bottom flanges attach to columns with complete joint penetration groove welds and weld backing is used at the bottom surface of the beam flange, such backing shall be removed and the root pass back-gouged, repaired and reinforced with a minimum $^3/_{16}$ inch (5 mm) fillet weld.*

2215A.2.4 Connection design. *Connections of beams to columns shall have the design strength to resist the maximum seismic load effect, E_m, calculated in accordance with Section 12.4.3 of ASCE 7.*

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2215A.2.5 Multistory assemblies. *Analysis of multistory assemblies shall be permitted to consider the stacked modules as a single assembly, with restraint conditions between the stacked units that represent the actual method of attachment. Alternatively, it shall be permitted to analyze the individual modules of stacked assemblies independently, with lateral and vertical reactions from modules above applied as concentrated loads at the top of the supporting module.*

SECTION 2216A—TESTING AND FIELD VERIFICATION

2216A.1 Tests of high-strength bolts, nuts and washers. *High-strength bolts, nuts and washers shall be sampled and tested in accordance with Section 1705A.2.8* ***[OSHPD 1 & 4]*** *and this section.*

[OSHPD 1 and 4] *A minimum of nine samples per lot, as defined in the ASTM standards for bolts [not nuts and washers], shall be tested for tensile properties in accordance with ASTM F606, but need not exceed three samples per 400 bolts.*

2216A.2 Tests of end-welded studs. *End-welded studs shall be tested in accordance with the requirements of the AWS D1.1, Clauses 9.7 and 9.8.*

Exception: *Fillet-welded studs exempted by AWS D1.1 Clause 9.5.*

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 23 – WOOD

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	**X**												**X**			**X**								
Adopt entire chapter as amended (amended sections listed below)				**X**	**X**			**X**	**X**	**X**	**X**	**X**		**X**	**X**									
Adopt only those sections that are listed below			**X**																			**X**		
Chapter / Section																								
2301.1				X																				
2301.1.1								X	X	X	X	X		X	X									
2301.1.2								X	X	X	X	X		X	X									
2301.1.3								X	X	X	X	X		X	X									
2303.1.3.1								X	X	X	X	X		X	X									
2301.1.4								X	X	X				X										
2301.1.4.1								X		X				X										
2301.1.4.2									X															
2301.1.5								X	X	X	X	X		X	X									
2303.2 – 2303.2.9			X																					
2303.4.1.4.1								X	X	X	X	X		X	X									
2303.4.3.1								X	X	X	X	X		X	X									
2304.3.1.1				X																				
2304.3.4								X	X	X	X	X		X	X									
2304.4.1								X	X	X	X	X		X	X									
2304.10.2.1								X		X	X	X		X	X									
2304.12.1.1.1																						X		
2304.12.1.2								X		X	X	X		X	X									
2304.12.1.4.1								X		X	X	X		X	X									
2304.12.8																						X		
2304.12.9																						X		
2305.1.3								X	X	X	X	X		X	X									
2308.2								X	X		X	X			X									
2308.2.8								X	X		X	X			X									
2309.1.1								X	X		X	X			X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

23 WOOD

User notes:

About this chapter: Chapter 23 provides minimum requirements for the design of buildings and structures that use wood and wood-based products. The chapter is organized around three design methodologies: allowable stress design (ASD), load and resistance factor design (LRFD) and conventional light-frame construction. In addition it allows the use of the American Wood Council Wood Frame Construction Manual for a limited range of structures. Included in the chapter are references to design and manufacturing standards for various wood and wood-based products; general construction requirements; design criteria for lateral force-resisting systems and specific requirements for the application of the three design methods.

ICC code development note: Code change proposals to sections preceded by the designation [BF] will be considered by a code development committee meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2025 (Group B) Code Development Cycle.

SECTION 2301—GENERAL

2301.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of wood members and their fasteners.

[HCD 1] *For limited-density owner-built rural dwellings, owner-produced or used materials and appliances may be utilized unless found not to be of sufficient strength or durability to perform the intended function; owner-produced or used lumber, or shakes and shingles may be utilized unless found to contain dry rot, excessive splitting or other defects obviously rendering the material unfit in strength or durability for the intended purpose.*

2301.1.1 Application. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *The scope of application of Chapter 23 is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Applications listed in Section 1.10, regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facilities, intermediate care facilities, correctional treatment centers and acute psychiatric hospital buildings.*

   Exception: *For applications listed in Sections 1.10.3 (Licensed Clinics) and 1.10.6 (Chemical Dependency Recovery Hospitals), the provisions of this chapter without OSHPD amendments identified in accordance with Section 2301.1.3 shall apply.*

2301.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *DSA-SS, DSA-SS/CC and OSHPD adopt this chapter as amended.*

2301.1.3 Identification of amendments. [DSA-SS, DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5]

1. *Division of the State Architect - Structural Safety amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS] *- For applications listed in Section 1.9.2.1.*

   [DSA-SS/CC] *- For applications listed in Section 1.9.2.2.*
2. *Office of Statewide Hospital Planning and Development (OSHPD) amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [OSHPD 1] *- For applications listed in Section 1.10.1.*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 4] *- For applications listed in Section 1.10.4.*

   [OSHPD 5] *- For applications listed in Section 1.10.5.*

2301.1.4 Reference to other chapters. [DSA-SS, DSA-SS/CC, OSHPD]

2301.1.4.1 [DSA-SS and OSHPD 1 & 4] *Where reference within this chapter is made to sections in Chapters 16, 17, 18, 19, 21 and 22, the provisions in Chapters 16A, 17A, 18A, 19A, 21A and 22A, respectively shall apply instead.*

2301.1.4.2 [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

2301.1.5 Prohibition. [DSA-SS & DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *The following design methods, systems and materials are not permitted by DSA and OSHPD:*

1. *Straight-sheathed horizontal lumber diaphragms.*
2. *Gypsum-based sheathing shear walls and portland cement plaster shear walls.*
3. *Shear wall foundation anchor bolt washers in accordance with exception to AWC SDPWS Section 4.3.6.4.3.*

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4. *Wood structural panel shear walls and diaphragms using staples as fasteners.*
5. *Unblocked shear walls.*
6. *Any wood structural panel sheathing used for diaphragms and shear walls that are part of the seismic force-resisting system, not applied directly to framing members.*
7. *Single and double diagonally sheathed lumber walls used to resist seismic forces.*
8. *Log structures in accordance with ICC 400.*
9. ***[OSHPD 1, 1R, 2, 4 & 5]** Cross-laminated timber used as part of the seismic force-resisting system, unless approved as an alternative system in accordance with Section 104.2.3. **[DSA-SS, DSA-SS/CC]** Not adopted by DSA.*

2301.2 Dimensions. For the purposes of this chapter, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions (see Section 2304.2). Where dimensions of cross-laminated timber thickness are specified, they shall be deemed to be actual dimensions.

SECTION 2302—DESIGN REQUIREMENTS

2302.1 General. The design of structural elements or systems, constructed partially or wholly of wood or wood-based products, shall be in accordance with one of the following methods:

1. Allowable stress design in accordance with Sections 2304, 2305 and 2306.
2. Load and resistance factor design in accordance with Sections 2304, 2305 and 2307.
3. Conventional light-frame construction in accordance with Sections 2304 and 2308.
4. AWC WFCM in accordance with Section 2309.
5. The design and construction of log structures in accordance with the provisions of ICC 400.

SECTION 2303—MINIMUM STANDARDS AND QUALITY

2303.1 General. Structural sawn lumber; end-jointed lumber; prefabricated wood I-joists; structural glued-laminated timber; cross-laminated timber; wood structural panels; fiberboard sheathing (where used structurally); hardboard siding (where used structurally); particleboard; preservative-treated wood; structural log members; structural composite lumber; round timber poles and piles; fire-retardant-treated wood; hardwood plywood; wood trusses; joist hangers; nails; and staples shall conform to the applicable provisions of this section.

2303.1.1 Sawn lumber. Sawn lumber used for load-supporting purposes, including end-jointed or edge-glued lumber, machine stress-rated or machine-evaluated lumber, shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20 or equivalent. Grading practices and identification shall comply with rules published by an agency approved in accordance with the procedures of DOC PS 20 or equivalent procedures.

2303.1.1.1 Certificate of inspection. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section is permitted to be accepted for precut, remanufactured or rough-sawn lumber and for sizes larger than 3 inches (76 mm) nominal thickness.

2303.1.1.2 End-jointed lumber. Approved end-jointed lumber is permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required to have a fire-resistance rating shall have the designation "Heat Resistant Adhesive" or "HRA" included in its grade mark.

2303.1.2 Prefabricated wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D5055.

2303.1.3 Structural glued-laminated timber. Glued-laminated timbers shall be manufactured and identified as required in ANSI/APA 190.1 and ASTM D3737.

***2303.1.3.1 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5]** The construction documents shall indicate the following:*

1. *Dry or wet service conditions.*
2. *Laminating combinations and stress requirements.*
3. *Species group.*
4. *Preservative material and retention, when preservative treatment is required.*
5. *Provisions for protection during shipping and field handling, such as sealing and wrapping in accordance with AITC 111.*

When mechanical reinforcement such as radial tension reinforcement is required, such reinforcement shall comply with AITC 404 and shall be detailed accordingly in the construction documents. Construction documents shall specify that the moisture content of laminations at the time of manufacture shall not exceed 12 percent for dry conditions of use.

The design of fasteners and connections shall comply with AITC 117, Section I, Item 6 (Connection Design), and NDS Appendix E.

2303.1.4 Cross-laminated timber. Cross-laminated timbers shall be manufactured and identified in accordance with ANSI/APA PRG 320.

***2303.1.4.1 Additional requirements. [DSA-SS & DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5]** Requirements in Section 2303.1.3.1 shall apply to cross-laminated timber.*

2303.1.5 Wood structural panels. Wood structural panels, where used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms and built-up members), shall conform to the requirements for their type in DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Each panel or member shall be identified for grade, bond classification, and Performance Category by the trademarks of an approved testing and grading agency. The Performance Category value shall be used as the "nominal panel thickness" or "panel thickness" whenever referenced in this code. Wood structural panel components shall be designed and fabricated in accordance with the applicable standards listed in Section 2306.1 and identified by the trademarks of an approved testing and inspection agency indicating conformance to the applicable standard. In addition, wood structural panels where permanently exposed in outdoor applications shall be of exterior type, except that wood structural panel roof sheathing exposed to the outdoors on the underside is permitted to be Exposure 1 type.

2303.1.6 Fiberboard. Fiberboard for its various uses shall conform to ASTM C208. Fiberboard sheathing, where used structurally, shall be identified by an approved agency as conforming to ASTM C208.

2303.1.6.1 Jointing. To ensure tight-fitting assemblies, edges shall be manufactured with square, shiplapped, beveled, tongue-and-groove or U-shaped joints.

2303.1.6.2 Roof insulation. Where used as roof insulation in all types of construction, fiberboard shall be protected with an approved roof covering.

2303.1.6.3 Wall insulation. Where installed and fireblocked to comply with Chapter 7, fiberboards are permitted as wall insulation in all types of construction. In fire walls and fire barriers, unless treated to comply with Section 803.1 for Class A materials, the boards shall be cemented directly to the concrete, masonry or other noncombustible base and shall be protected with an approved noncombustible veneer anchored to the base without intervening airspaces.

2303.1.6.3.1 Protection. Fiberboard wall insulation applied on the exterior of foundation walls shall be protected below ground level with a bituminous coating.

2303.1.7 Hardboard. Hardboard siding shall conform to the requirements of ANSI A135.6 and, where used structurally, shall be identified by the label of an approved agency. Hardboard underlayment shall meet the strength requirements of $^{7}/_{32}$-inch (5.6 mm) or $^{1}/_{4}$-inch (6.4 mm) service class hardboard planed or sanded on one side to a uniform thickness of not less than 0.200 inch (5.1 mm). Prefinished hardboard paneling shall meet the requirements of ANSI A135.5. Other basic hardboard products shall meet the requirements of ANSI A135.4. Hardboard products shall be installed in accordance with manufacture's recommendations.

2303.1.8 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency. Particleboard shall not be utilized for applications other than indicated in this section unless the particleboard complies with the provisions of Section 2306.3.

2303.1.8.1 Floor underlayment. Particleboard floor underlayment shall conform to Type PBU of ANSI A208.1. Type PBU underlayment shall be not less than $^{1}/_{4}$-inch (6.4 mm) thick and shall be installed in accordance with the instructions of the Composite Panel Association.

2303.1.9 Preservative-treated wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.12 to be preservative treated shall conform to AWPA U1 and M4. Lumber and plywood used in permanent wood foundation systems shall conform to Chapter 18.

2303.1.9.1 Identification. Wood required by Section 2304.12 to be preservative treated shall bear the quality mark of an inspection agency that maintains continuing supervision, testing and inspection over the quality of the preservative-treated wood. Inspection agencies for preservative-treated wood shall be listed by an accreditation body that complies with the requirements of the American Lumber Standards Treated Wood Program, or equivalent. The quality mark shall be on a stamp or label affixed to the preservative-treated wood, and shall include the following information:

1. Identification of treating manufacturer.
2. Type of preservative used.
3. Minimum preservative retention (pcf).
4. End use for which the product is treated.
5. AWPA standard to which the product was treated.
6. Identity of the accredited inspection agency.

2303.1.9.2 Moisture content. Where preservative-treated wood is used in enclosed locations where drying in service cannot readily occur, such wood shall be at a moisture content of 19 percent or less before being covered with insulation, interior wall finish, floor covering or other materials.

2303.1.10 Structural composite lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D5456.

2303.1.11 Structural log members. Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section shall be permitted.

2303.1.12 Round timber poles and piles. Round timber poles and piles shall comply with ASTM D3200 and ASTM D25, respectively.

2303.1.13 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

[BF] 2303.2 Fire-retardant-treated wood. Fire-retardant-treated wood is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less. The ASTM E84 or UL 723 test shall be continued for an additional 20-minute period and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test.

[BF] 2303.2.1 Alternate fire testing. Fire-retardant-treated wood is also any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E2768, a listed flame spread index of 25 or less and where the flame front does not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test.

[BF] 2303.2.2 Pressure process. For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (345 kPa).

[BF] 2303.2.3 Other means during manufacture. For wood products impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of paints, coating, stains or other surface treatments is not an approved method of protection as required in this section.

[BF] 2303.2.4 Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of $^{1}/_{8}$ inch (3.2 mm).

[BF] 2303.2.5 Labeling. In addition to the labels required in Section 2303.1.1 for sawn lumber and Section 2303.1.5 for wood structural panels, each piece of fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain the following items:

1. The identification mark of an approved agency in accordance with Section 1703.5.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke-developed index.
6. Method of drying after treatment.
7. Conformance with appropriate standards in accordance with Sections 2303.2.6 through 2303.2.9.
8. For fire-retardant-treated wood exposed to weather, damp or wet locations, include the words “No increase in the listed classification when subjected to the Standard Rain Test” (ASTM D2898).

2303.2.6 Design values. Design values for fire-retardant-treated wood, including connection design values, shall be subject to all adjustments applicable to untreated wood as specified in this chapter and shall be further adjusted to account for the effects of the fire-retardant treatment. Adjustments to design values for the effects of the fire-retardant treatment shall be based on an approved method of investigation that takes into consideration the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures. Adjustments to flexural design values for fire-retardant-treated plywood shall be determined in accordance with Section 2303.2.6.1. Adjustments to flexural, tension, compression and shear design values for fire-retardant-treated lumber shall be determined in accordance with Section 2303.2.6.2. Design values and treatment adjustment factors for fire-retardant-treated laminated veneer lumber shall be determined in accordance with Section 2303.2.6.3.

2303.2.6.1 Fire-retardant-treated plywood. The effect of treatment and redrying after treatment, and any treatment-based effects due to exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed in accordance with ASTM D5516 shall be used to develop treatment adjustment factors in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment based on the adjusted design values and taking into account the climatological location.

2303.2.6.2 Fire-retardant-treated lumber. For each species of wood that is treated, the effect of treatment and redrying after treatment and any treatment-based effects due to exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed in accordance with ASTM D5664 shall be used to develop treatment adjustment factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the treatment adjustment factors for service at maximum temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

2303.2.6.3 Fire-retardant-treated laminated veneer lumber. The effect of treatment and redrying after treatment and any treatment-based effects due to exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated laminated veneer lumber shall be determined in accordance with ASTM D8223. Each manufacturer shall publish reference design values and treatment-based design value adjustment factors in accordance with ASTM D8223, taking into account the climatological location.

[BF] 2303.2.7 Exposure to weather, damp or wet locations. Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as "Exterior" to indicate there is no increase in the listed flame spread index as defined in Section 2303.2 when subjected to ASTM D2898.

2303.2.8 Interior applications. Interior fire-retardant-treated wood shall have moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section 2303.2.6.1 or 2303.2.6.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

2303.2.9 Moisture content. Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln-dried after treatment (KDAT), the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section 2303.2.6.1 for plywood and 2303.2.6.2 for lumber.

2303.2.10 Types I and II construction applications. See Section 603.1 for limitations on the use of fire-retardant-treated wood in buildings of Type I or II construction.

2303.3 Hardwood and plywood. Hardwood and decorative plywood shall be manufactured and identified as required in HPVA HP-1.

2303.4 Trusses. Wood trusses shall comply with Sections 2303.4.1 through 2303.4.7.

2303.4.1 Design. Wood trusses shall be designed in accordance with the provisions of this code and accepted engineering practice. Members are permitted to be joined by nails, glue, bolts, timber connectors, metal connector plates or other approved framing devices.

2303.4.1.1 Truss design drawings. The written, graphic and pictorial depiction of each individual truss shall be provided to the building official for approval prior to installation. Truss design drawings shall be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the following information:

1. Slope or depth, span and spacing.
2. Location of all joints and support locations.
3. Number of plies if greater than one.
4. Required bearing widths.
5. Design loads as applicable, including:
    5.1. Top chord live load.
    5.2. Top chord dead load.
    5.3. Bottom chord live load.
    5.4. Bottom chord dead load.
    5.5. Additional loads and locations.
    5.6. Environmental design criteria and loads (such as wind, rain, snow, seismic).
6. Other lateral loads, including drag strut loads.
7. Adjustments to wood member and metal connector plate design value for conditions of use.
8. Maximum reaction force and direction, including maximum uplift reaction forces where applicable.
9. Joint connection type and description, such as size and thickness or gage, and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
10. Size, species and grade for each wood member.
11. Truss-to-truss connections and truss field assembly requirements.
12. Calculated span-to-deflection ratio and maximum vertical and horizontal deflection for live and total load as applicable.
13. Maximum axial tension and compression forces in the truss members.
14. Required permanent individual truss member restraint location and the method and details of restraint and diagonal bracing to be used in accordance with Section 2303.4.1.2.

2303.4.1.2 Permanent individual truss member restraint (PITMR) and permanent individual truss member diagonal bracing (PITMDB). Where the truss design drawings designate the need for permanent individual truss member restraint, it shall be accomplished by one of the following methods:

1. PITMR and PITMDB installed using standard industry lateral restraint and diagonal bracing details in accordance with TPI 1, Section 2.3.3.1.1, accepted engineering practice, or Figures 2303.4.1.2(1), (3), and (5).
2. Individual truss member reinforcement in place of the specified lateral restraints (i.e., buckling reinforcement such as T-reinforcement, L-reinforcement, proprietary reinforcement, etc.) such that the buckling of any individual truss member is resisted internally by the individual truss. The buckling reinforcement of individual truss members shall be installed as shown on the truss design drawing, on supplemental truss member buckling reinforcement details provided by the truss designer or in accordance with Figures 2303.4.1.2 (2) and (4).
3. A project-specific PITMR and PITMDB design provided by any registered design professional.

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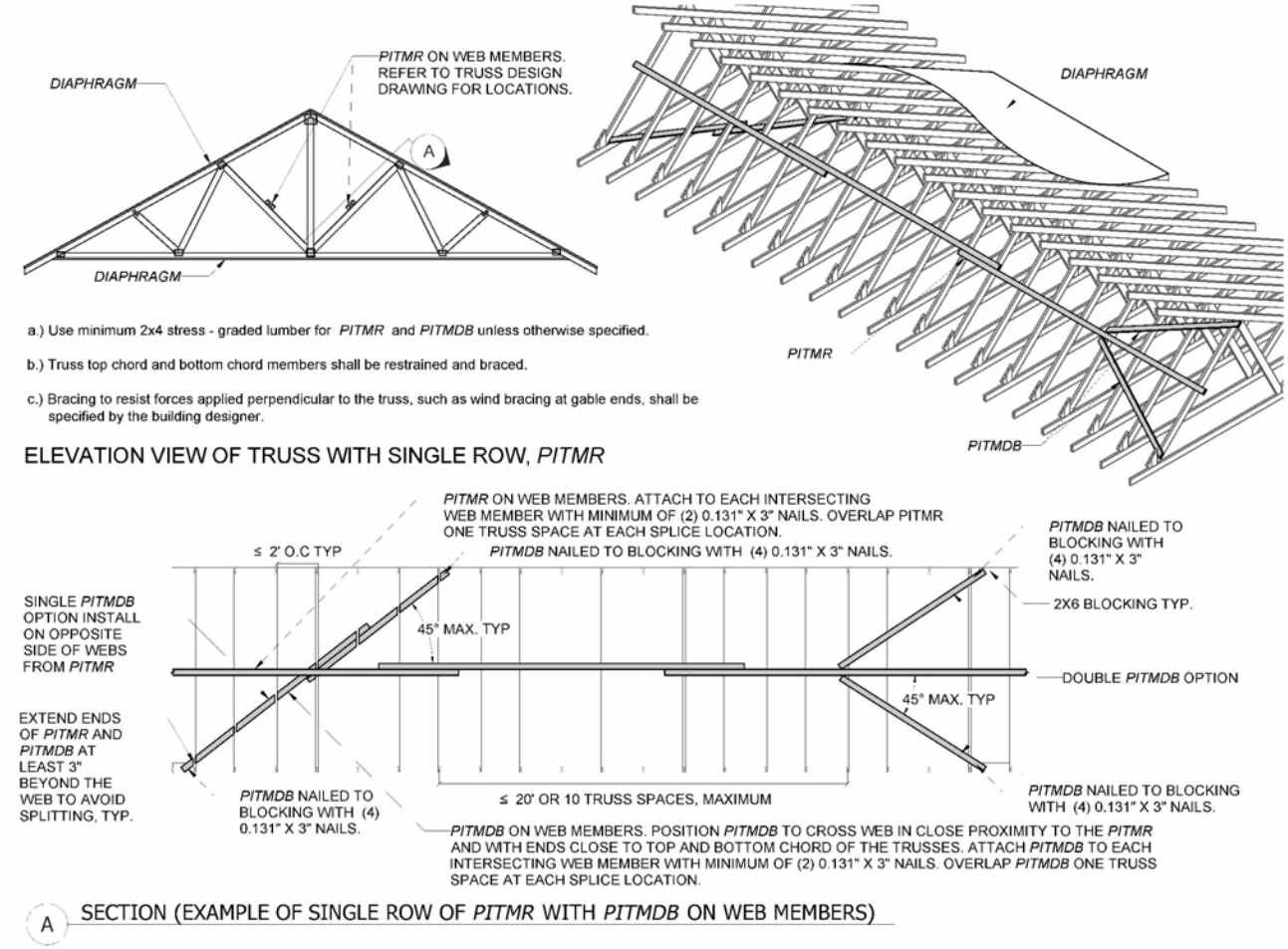
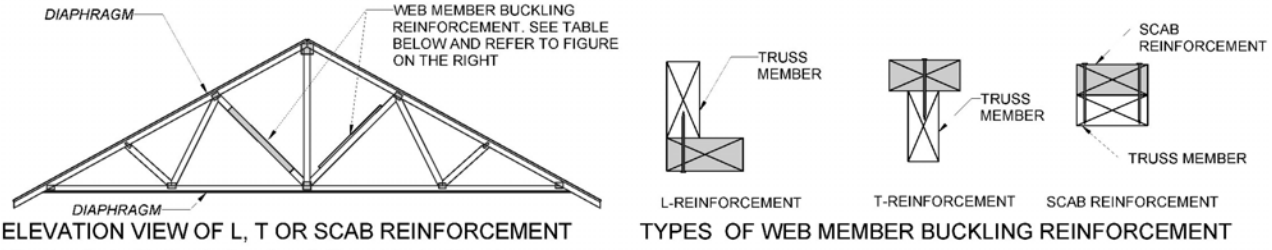
FIGURE 2303.4.1.2 (1)—PITMR AND PITMDB FOR TRUSS WEB MEMBERS REQUIRING ONE ROW OF PITMR


DIAPHRAGM
PITMR ON WEB MEMBERS. REFER TO TRUSS DESIGN DRAWING FOR LOCATIONS.
A
DIAPHRAGM
DIAPHRAGM
PITMR
PITMDB
a.) Use minimum 2x4 stress - graded lumber for PITMR and PITMDB unless otherwise specified.
b.) Truss top chord and bottom chord members shall be restrained and braced.
c.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.
ELEVATION VIEW OF TRUSS WITH SINGLE ROW, PITMR
PITMR ON WEB MEMBERS. ATTACH TO EACH INTERSECTING WEB MEMBER WITH MINIMUM OF (2) 0.131" X 3" NAILS. OVERLAP PITMR ONE TRUSS SPACE AT EACH SPLICE LOCATION.
≤ 2' O.C TYP
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
2X6 BLOCKING TYP.
SINGLE PITMDB OPTION INSTALL ON OPPOSITE SIDE OF WEBS FROM PITMR
45° MAX. TYP
DOUBLE PITMDB OPTION
45° MAX. TYP
EXTEND ENDS OF PITMR AND PITMDB AT LEAST 3" BEYOND THE WEB TO AVOID SPLITTING, TYP.
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
≤ 20' OR 10 TRUSS SPACES, MAXIMUM
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
PITMDB ON WEB MEMBERS. POSITION PITMDB TO CROSS WEB IN CLOSE PROXIMITY TO THE PITMR AND WITH ENDS CLOSE TO TOP AND BOTTOM CHORD OF THE TRUSSES. ATTACH PITMDB TO EACH INTERSECTING WEB MEMBER WITH MINIMUM OF (2) 0.131" X 3" NAILS. OVERLAP PITMDB ONE TRUSS SPACE AT EACH SPLICE LOCATION.
A
SECTION (EXAMPLE OF SINGLE ROW OF PITMR WITH PITMDB ON WEB MEMBERS)

For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(2)—ALTERNATIVE INSTALLATION USING BUCKLING REINFORCEMENT FOR TRUSS WEB MEMBERS IN LIEU OF ONE ROW OF PITMR



a.) Truss top chord and bottom chord members shall be restrained and braced.

b.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.

c.) Use the table below unless project specific web member reinforcement is provided on the truss design drawing or supplemental truss buckling reinforcement details are provided by the truss designer.

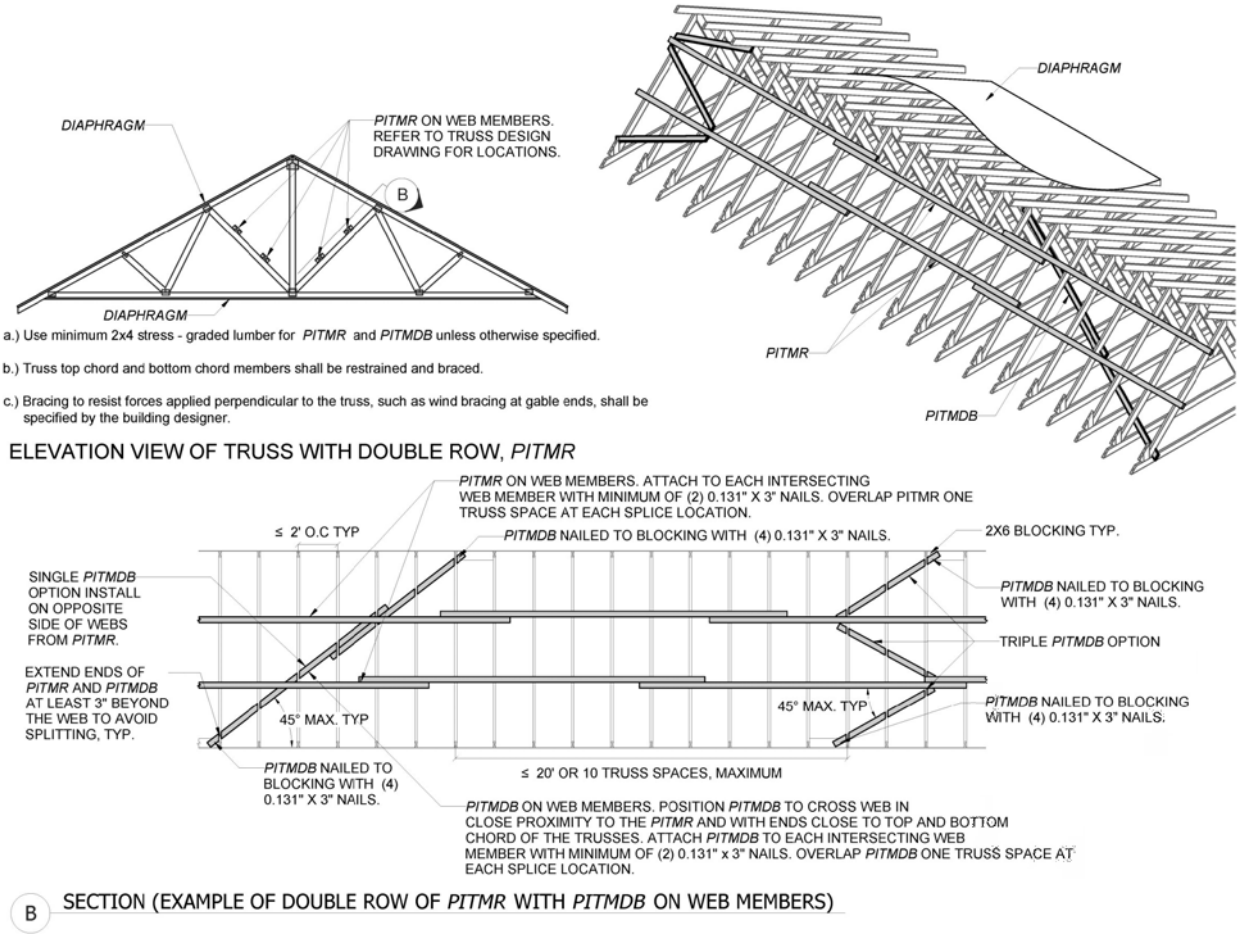
NUMBER OF ROWS OF PITMR SPECIFIED ON WEB MEMBER	SIZE OF TRUSS WEB	TYPE AND SIZE OF WEB REINFORCEMENT[1] FOR T, L OR SCAB[2]	GRADE OF WEB REINFORCEMENT	MINIMUM LENGTH OF WEB REINFORCEMENT	MINIMUM CONNECTION OF WEB REINFORCEMENT TO WEB
ONE	2x4	2x4	Same species and grade or better than web member	90% of web or extend to within 6" of end of web member, whichever is greater	(0.131" x 3") nails at 6" on-center[2]
	2x6	2x6			
	2x8	2x8			

[1]Maximum allowable web length is 14'

[2]Attach Scab reinforcement to web with two rows of minimum 0.131" x 3" nails at 6" on-center

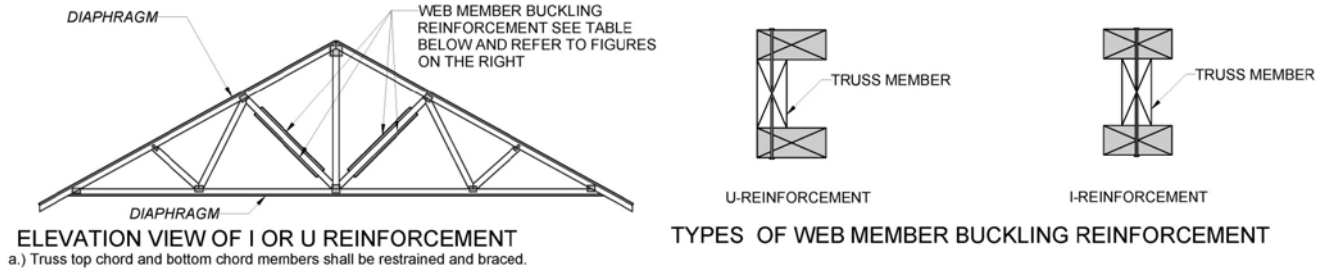
For SI:1 inch - 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(3)—PITMR AND PITMDB FOR TRUSS WEB MEMBERS REQUIRING TWO ROWS OF PITMR


DIAPHRAGM
PITMR ON WEB MEMBERS. REFER TO TRUSS DESIGN DRAWING FOR LOCATIONS.
B
DIAPHRAGM
a.) Use minimum 2x4 stress - graded lumber for PITMR and PITMDB unless otherwise specified.
b.) Truss top chord and bottom chord members shall be restrained and braced.
c.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.
DIAPHRAGM
PITMR
PITMDB
ELEVATION VIEW OF TRUSS WITH DOUBLE ROW, PITMR
PITMR ON WEB MEMBERS. ATTACH TO EACH INTERSECTING WEB MEMBER WITH MINIMUM OF (2) 0.131" X 3" NAILS. OVERLAP PITMR ONE TRUSS SPACE AT EACH SPLICE LOCATION.
≤ 2' O.C TYP
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
2X6 BLOCKING TYP.
SINGLE PITMDB OPTION INSTALL ON OPPOSITE SIDE OF WEBS FROM PITMR.
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
TRIPLE PITMDB OPTION
EXTEND ENDS OF PITMR AND PITMDB AT LEAST 3" BEYOND THE WEB TO AVOID SPLITTING, TYP.
45° MAX. TYP
45° MAX. TYP
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
PITMDB NAILED TO BLOCKING WITH (4) 0.131" X 3" NAILS.
≤ 20' OR 10 TRUSS SPACES, MAXIMUM
PITMDB ON WEB MEMBERS. POSITION PITMDB TO CROSS WEB IN CLOSE PROXIMITY TO THE PITMR AND WITH ENDS CLOSE TO TOP AND BOTTOM CHORD OF THE TRUSSES. ATTACH PITMDB TO EACH INTERSECTING WEB MEMBER WITH MINIMUM OF (2) 0.131" x 3" NAILS. OVERLAP PITMDB ONE TRUSS SPACE AT EACH SPLICE LOCATION.
B SECTION (EXAMPLE OF DOUBLE ROW OF PITMR WITH PITMDB ON WEB MEMBERS)

For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(4)—ALTERNATIVE INSTALLATION USING BUCKLING REINFORCEMENT FOR TRUSS WEB MEMBERS IN LIEU OF TWO ROWS OF PITMR



a.) Truss top chord and bottom chord members shall be restrained and braced.

b.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.

c.) Use the table below unless project specific web member reinforcement is provided on the truss design drawing or supplemental truss buckling reinforcement details are provided by the truss designer.

NUMBER OF ROWS OF PITMR SPECIFIED ON WEB MEMBER	SIZE OF TRUSS WEB	TYPE AND SIZE OF WEB FOR I OR U REINFORCEMENT[1]	GRADE OF WEB REINFORCEMENT	MINIMUM LENGTH OF WEB REINFORCEMENT	MINIMUM CONNECTION OF WEB REINFORCEMENT TO WEB
TWO	2x4	(2) -2x4	Same species and grade or better than web member	90% of web or extend to within 6" of end of web member, whichever is greater	(0.131" x 3") nails at 6" on-center
	2x6	(2) -2x6			
	2x8	(2) -2x8			

[1]Maximum allowable web length is 14'

For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.

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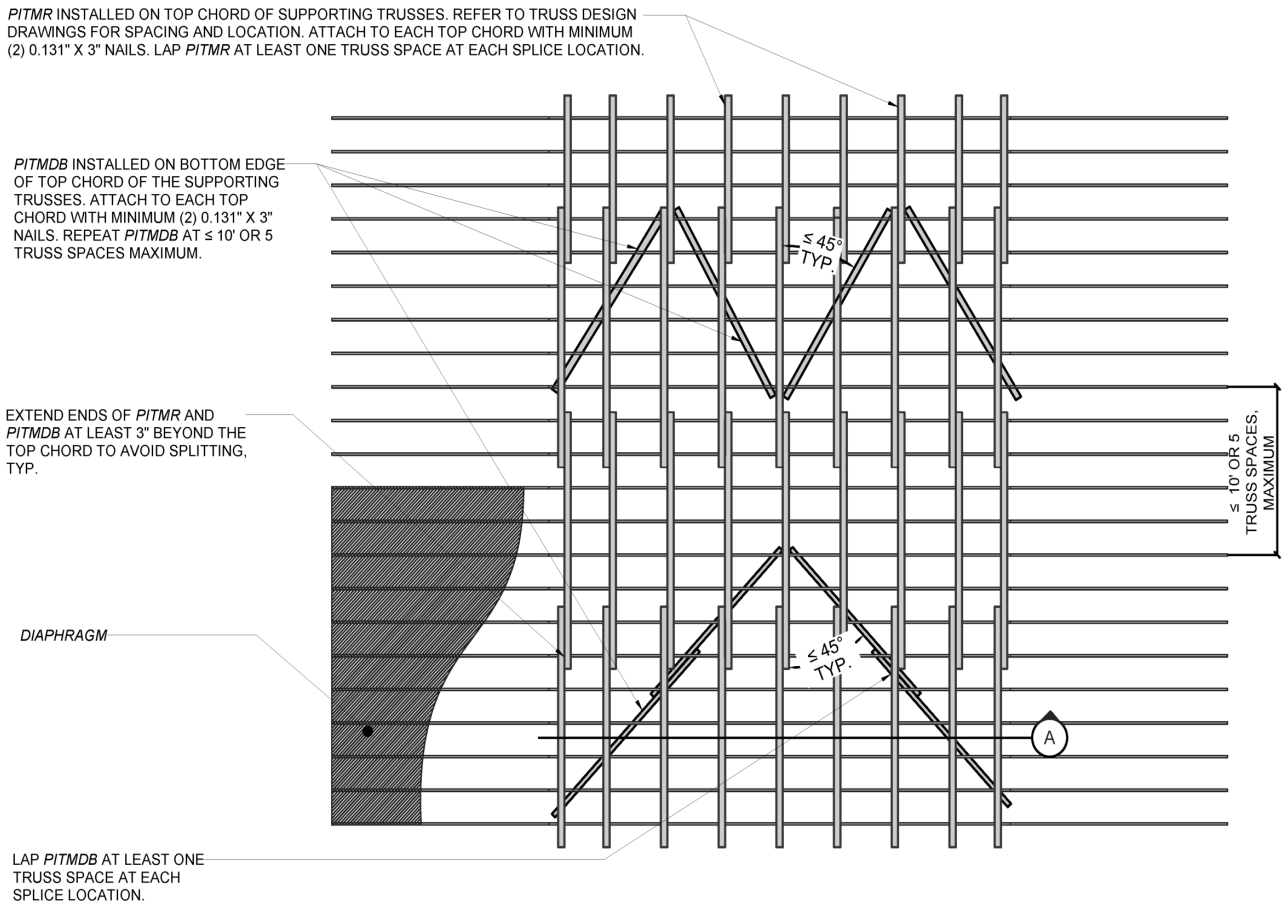
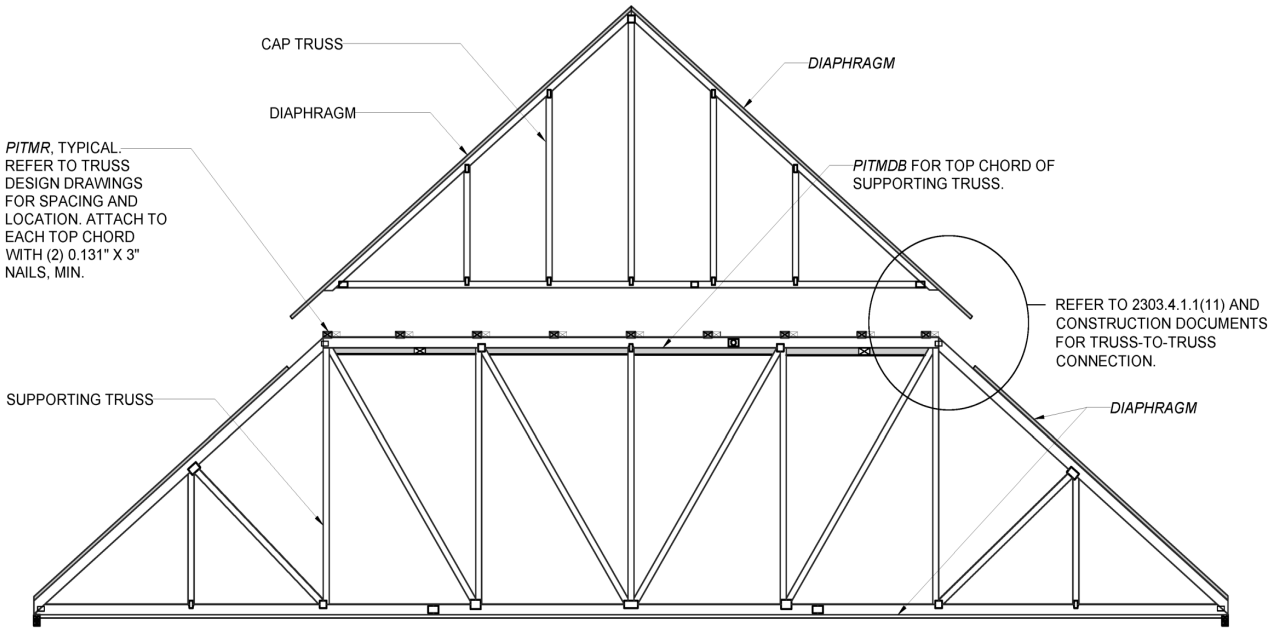
FIGURE 2303.4.1.2(5)—PITMR AND PITMDB FOR FLAT PORTION OF TOP CHORD IN A PIGGYBACK ASSEMBLY


PITMR INSTALLED ON TOP CHORD OF SUPPORTING TRUSSES. REFER TO TRUSS DESIGN DRAWINGS FOR SPACING AND LOCATION. ATTACH TO EACH TOP CHORD WITH MINIMUM (2) 0.131" X 3" NAILS. LAP *PITMR* AT LEAST ONE TRUSS SPACE AT EACH SPLICE LOCATION.
PITMDB INSTALLED ON BOTTOM EDGE OF TOP CHORD OF THE SUPPORTING TRUSSES. ATTACH TO EACH TOP CHORD WITH MINIMUM (2) 0.131" X 3" NAILS. REPEAT *PITMDB* AT ≤ 10' OR 5 TRUSS SPACES MAXIMUM.
EXTEND ENDS OF *PITMR* AND *PITMDB* AT LEAST 3" BEYOND THE TOP CHORD TO AVOID SPLITTING, TYP.
DIAPHRAGM
LAP *PITMDB* AT LEAST ONE TRUSS SPACE AT EACH SPLICE LOCATION.
≤ 45° TYP.
≤ 45° TYP.
≤ 10' OR 5 TRUSS SPACES, MAXIMUM
A

PLAN VIEW


CAP TRUSS
DIAPHRAGM
DIAPHRAGM
PITMR, TYPICAL. REFER TO TRUSS DESIGN DRAWINGS FOR SPACING AND LOCATION. ATTACH TO EACH TOP CHORD WITH (2) 0.131" X 3" NAILS, MIN.
PITMDB FOR TOP CHORD OF SUPPORTING TRUSS.
REFER TO 2303.4.1.1(11) AND CONSTRUCTION DOCUMENTS FOR TRUSS-TO-TRUSS CONNECTION.
SUPPORTING TRUSS
DIAPHRAGM

a.) Use minimum 2x4 stress - graded lumber for *PITMR* and *PITMDB* unless otherwise specified.
b.) Web *PITMR* and *PITMDB* not shown for clarity.
c.) Truss top chord and bottom chord members shall be restrained and braced.
d.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.

SECTION AT A

For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.

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2303.4.1.2.1 Trusses installed without a diaphragm. Trusses installed without a diaphragm on the top or bottom chord shall require a project specific PITMR and PITMDB design prepared by a registered design professional.

Exception: Group U occupancies.

2303.4.1.3 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with any qualified registered design professional for the design of the temporary installation restraint and diagonal bracing and the PITMR and PITMDB for all trusses with clear spans 60 feet (18 288 mm) or greater.

2303.4.1.4 Truss designer. The individual or organization responsible for the design of trusses.

2303.4.1.4.1 Truss design drawings. Where required by the registered design professional, the building official or the statutes of the jurisdiction in which the project is to be constructed, each individual truss design drawing shall bear the seal and signature of the truss designer.

Exceptions:

1. Where a cover sheet and truss index sheet are combined into a single sheet and attached to the set of truss design drawings, the single cover/truss index sheet is the only document required to be signed and sealed by the truss designer.
2. Where a cover sheet and a truss index sheet are separately provided and attached to the set of truss design drawings, the cover sheet and the truss index sheet are the only documents required to be signed and sealed by the truss designer.
3. ***[DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5]*** *Exceptions 1 and 2 are not permitted by DSA and OSHPD.*

2303.4.2 Truss placement diagram. The truss manufacturer shall provide a truss placement diagram that identifies the proposed location for each individually designated truss and references the corresponding truss design drawing. The truss placement diagram shall be provided as part of the truss submittal package, and with the shipment of trusses delivered to the job site. Truss placement diagrams that serve only as a guide for installation and do not deviate from the permit submittal drawings shall not be required to bear the seal or signature of the truss designer.

2303.4.3 Truss submittal package. The truss submittal package provided by the truss manufacturer shall consist of each individual truss design drawing, the truss placement diagram, the permanent individual truss member restraint/bracing method and details and any other structural details germane to the trusses; and, as applicable, the cover/truss index sheet.

2303.4.3.1 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *In addition to Sections 2303.4.1 and 2303.4.2, the following requirements apply:*

1. ***Construction documents.*** *The construction documents prepared by the registered engineer or licensed architect for the project shall indicate all requirements for the truss design, including:*
   - *1.1 Deflection criteria.*
   - *1.2 Connection details to structural and non-structural elements (e.g. non-bearing partitions).*
2. ***Requirements for approval.*** *The truss design drawings and engineering analysis shall be provided to the enforcement agency and approved prior to truss fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Alterations to the approved truss design drawings or manufactured trusses are subject to the approval of the enforcement agency.*

2303.4.4 Anchorage. The design for the transfer of loads and anchorage of each truss to the supporting structure is the responsibility of the registered design professional.

2303.4.5 Alterations to trusses. Truss members and components shall not be cut, notched, drilled, spliced or otherwise altered in any way without written concurrence and approval of a registered design professional. Alterations resulting in the addition of loads to any member (for example, HVAC equipment, piping, additional roofing or insulation) shall not be permitted without verification that the truss is capable of supporting such additional loading.

2303.4.6 TPI 1 specifications. In addition to Sections 2303.4.1 through 2303.4.5, the design, manufacture and quality assurance of metal-plate-connected wood trusses shall be in accordance with TPI 1. Job-site inspections shall be in compliance with Section 110.4, as applicable.

2303.4.7 Truss quality assurance. Trusses not part of a manufacturing process in accordance with either Section 2303.4.6 or a referenced standard, which provides requirements for quality control done under the supervision of a third-party quality control agency, shall be manufactured in compliance with Sections 1704.2.5 and 1705.5, as applicable.

2303.5 Test standard for joist hangers. Joist hangers shall be in accordance with ASTM D7147.

2303.6 Nails and staples. Nails and staples shall conform to requirements of ASTM F1667, including Supplement 1. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as follows: 80 kips per square inch (ksi) (551 MPa) for shank diameters larger than 0.177 inch (4.50 mm) but not larger than 0.254 inch (6.45 mm), 90 ksi (620 MPa) for shank diameters larger than 0.142 inch (3.61 mm) but not larger than 0.177 inch (4.50 mm) and 100 ksi (689 MPa) for shank diameters of not less than 0.099 inch (2.51 mm) but not larger than 0.142 inch (3.61 mm). Staples used for framing and sheathing connections shall have minimum average bending moments as follows: 3.6 in.-lbs (0.41 N-m) for No. 16 gage staples, 4.0 in.-lbs (0.45 N-m) for No. 15 gage staples, and 4.3 in.-lbs (0.49 N-m) for No. 14 gage staples.

2303.7 Shrinkage. Consideration shall be given in design for the effects of wood cross-grain dimensional changes that occur as a result of changes in the wood moisture content after installation.

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SECTION 2304—GENERAL CONSTRUCTION REQUIREMENTS

2304.1 General. The provisions of this section apply to design methods specified in Section 2302.1.

2304.2 Size of structural members. Computations to determine the required sizes of members shall be based on the net dimensions (actual sizes) and not nominal sizes.

2304.3 Wall framing. The framing of exterior and interior walls shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

2304.3.1 Bottom plates. Studs shall have full bearing on a 2-inch-thick (actual $1^1/_2$-inch, 38 mm) or larger plate or sill having a width not less than equal to the width of the studs.

2304.3.1.1 [HCD 1] Rodent proofing. *Annular spaces around pipes, electric cables, conduits or other openings in bottom/sole plates at exterior walls shall be protected against the passage of rodents by closing such openings in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.4.*

2304.3.2 Framing over openings. Headers, double joists, trusses or other approved assemblies that are of adequate size to transfer loads to the vertical members shall be provided over window and door openings in load-bearing walls and partitions.

2304.3.3 Shrinkage. Wood walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the building official shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

2304.3.4 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *The following additional requirements apply:*

1. *Engineering analysis shall be furnished that demonstrates compliance of wall framing elements and connections with Section 2302.1, Item 1 or 2.*
2. *Construction documents shall include detailing of sill plate anchorage to supporting masonry or concrete for all exterior and interior bearing, nonbearing and shear walls. Unless specifically designed in accordance with Item 1 above, sills under exterior walls, bearing walls and shear walls shall be bolted to masonry or concrete with $^5/_8$ inch diameter by 12-inch (16 mm by 305 mm) bolts spaced not more than four (4) feet (1219 mm) on center, with a minimum of two (2) bolts for each piece of sill plate. Anchor bolts shall have a 4 inch minimum and a 12-inch maximum clearance to the end of the sill plate, and 7-inch minimum embedment into concrete or masonry.*

   Unless specifically designed in accordance with Item 1 above, sill plates under nonbearing interior partitions on concrete floor slabs shall be anchored at not more than four (4) feet (1219 mm) on center to resist a minimum allowable stress shear of 100 pounds per linear foot (1.4 kN/m) acting either parallel or perpendicular to the wall.
3. *Construction documents shall include detailing and limitations for notches and bored holes in wall studs, plates and sills.*

2304.4 Floor and roof framing. The framing of wood-joisted floors and wood-framed roofs shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

2304.4.1 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *The following additional requirements apply:*

1. *Engineering analysis shall be furnished that demonstrates compliance of floor, roof and ceiling framing elements and connections with Section 2302.1, Items 1 or 2.*
2. *Construction documents shall include detailing and limitations for notches and bored holes in floor and roof framing members.*

2304.5 Framing around flues and chimneys. Combustible framing shall be not less than 2 inches (51 mm), but shall be not less than the distance specified in Sections 2111 and 2113 and the *California Mechanical Code*, from flues, chimneys and fireplaces, and 6 inches (152 mm) away from flue openings.

2304.6 Exterior wall sheathing. Wall sheathing on the outside of exterior walls, including gables, and the connection of the sheathing to framing shall be designed in accordance with the general provisions of this code and shall be capable of resisting wind pressures in accordance with Section 1609.

2304.6.1 Wood structural panel sheathing. Where wood structural panel sheathing is used as the exposed finish on the outside of exterior walls, it shall have an exterior exposure durability classification. Where wood structural panel sheathing is used elsewhere, but not as the exposed finish, it shall be of a type manufactured with exterior glue (Exposure 1 or Exterior). Wood structural panel sheathing, connections and framing spacing shall be in accordance with Table 2304.6.1 for the applicable basic wind speed and exposure category where used in enclosed buildings with a mean roof height not greater than 30 feet (9144 mm) and a topographic factor (K_{zt}) of 1.0.

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TABLE 2304.6.1—MAXIMUM BASIC WIND SPEED, *V*, PERMITTED FOR WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES[a, b, c]

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		MAXIMUM BASIC WIND SPEED, *V* (MPH)		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	Wind exposure category		
							B	C	D
6d common (2.0" × 0.113")	1.5	24/0	3/8	16	6	12[d]	140	115	110
		24/16	7/16	16	6	12[d]	150	125	115
						6[d]	190	160	150
8d common (2.5" × 0.131")	1.75	24/16	7/16	16	6	12[d]	170	140	135
						6[d]	190	160	150
				24	6	12[d]	140	115	110
						6[d]	140	115	110

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. Panel strength axis shall be parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.

b. The table is based on wind pressures acting toward and away from building surfaces in accordance with Section 30.4 of ASCE 7. Lateral requirements shall be in accordance with Section 2305 or 2308.

c. Wood structural panels with span ratings of wall-16 or wall-24 shall be permitted as an alternative to panels with a 24/0 span rating. Plywood siding rated 16 on center or 24 on center shall be permitted as an alternative to panels with a 24/16 span rating. Wall-16 and plywood siding 16 on center shall be used with studs spaced not more than 16 inches on center.

d. Where the specific gravity of the wood species used for wall framing is greater than or equal to 0.35 but less than 0.42 in accordance with AWC NDS, nail spacing in the field of the panel shall be multiplied by 0.67. Where the specific gravity of the wood species used for wall framing is less than 0.35, fastening of the wall sheathing shall be designed in accordance with AWC NDS.

2304.7 Interior paneling. Softwood wood structural panels used for interior paneling shall conform to the provisions of Chapter 8 and shall be installed in accordance with Table 2304.10.2. Panels shall comply with DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Prefinished hardboard paneling shall meet the requirements of ANSI A135.5. Hardwood plywood shall conform to HPVA HP-1.

2304.8 Floor and roof sheathing. Structural floor sheathing and structural roof sheathing shall comply with Sections 2304.8.1 and 2304.8.2, respectively.

TABLE 2304.8(1)—ALLOWABLE SPANS FOR LUMBER FLOOR AND ROOF SHEATHING

SPAN (inches)	MINIMUM NET THICKNESS (inches) OF LUMBER PLACED			
	Perpendicular to supports		Diagonally to supports	
	Surfaced dry[a]	Surfaced unseasoned	Surfaced dry[a]	Surfaced unseasoned
Floors				
24	3/4	25/32	3/4	25/32
16	5/8	11/16	5/8	11/16
Roofs				
24	5/8	11/16	3/4	25/32

For SI: 1 inch = 25.4 mm.

a. Maximum 19-percent moisture content.

TABLE 2304.8(2)—SHEATHING LUMBER, MINIMUM GRADE REQUIREMENTS: BOARD GRADE

SOLID FLOOR OR ROOF SHEATHING	SPACED ROOF SHEATHING	GRADING RULES
Utility	Standard	NLGA, PLIB/WCLIB, or WWPA
4 common or utility	3 common or standard	NLGA, PLIB/WCLIB, WWPA, or NELMA
No. 3	No. 2	SPIB
Merchantable	Construction common	RIS

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TABLE 2304.8(3)—ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANEL SHEATHING AND SINGLE-FLOOR GRADES CONTINUOUS OVER TWO OR MORE SPANS WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS[a]

SHEATHING GRADES		ROOF[b]				FLOOR[c]
Panel span rating roof/floor span	Panel thickness (inches)	Maximum span (inches)		Load[d] (psf)		Maximum span (inches)
		With edge support[e]	Without edge support	Total load	Live load	
16/0	3/8	16	16	40	30	0
20/0	3/8	20	20	40	30	0
24/0	3/8, 7/16, 1/2	24	20[f]	40	30	0
24/16	7/16, 1/2	24	24	50	40	16
32/16	15/32, 1/2, 5/8	32	28	40	30	16[g]
40/20	19/32, 5/8, 3/4, 7/8	40	32	40	30	20[g,h]
48/24	23/32, 3/4, 7/8	48	36	45	35	24
54/32	7/8, 1	54	40	45	35	32
60/32	7/8, 1 1/8	60	48	45	35	32
SINGLE FLOOR GRADES		**ROOF[b]**				**FLOOR[c]**
Panel span rating	Panel thickness (inches)	Maximum span (inches)		Load[e] (psf)		Maximum span (inches)
		With edge support[e]	Without edge support	Total load	Live load	
16 o.c.	1/2, 19/32, 5/8	24	24	50	40	16[g]
20 o.c.	19/32, 5/8, 3/4	32	32	40	30	20[g,h]
24 o.c.	23/32, 3/4	48	36	35	25	24
32 o.c.	7/8, 1	48	40	50	40	32
48 o.c.	1 3/32, 1 1/8	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Applies to panels 24 inches or wider.

b. Uniform load deflection limitations 1/180 of span under live load plus dead load, 1/240 under live load only.

c. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking unless 1/4-inch minimum thickness underlayment or 1 1/2 inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is 3/4-inch wood strip. Allowable uniform load based on deflection of 1/360 of span is 100 pounds per square foot except the span rating of 48 inches on center is based on a total load of 65 pounds per square foot.

d. Allowable load at maximum span. Where the total load includes snow, use allowable stress design snow loads.

e. Tongue-and-groove edges, panel edge clips (one midway between each support, except two equally spaced between supports 48 inches on center), lumber blocking or other. Only lumber blocking shall satisfy blocked diaphragm requirements.

f. For 1/2-inch panel, maximum span shall be 24 inches.

g. Span is permitted to be 24 inches on center where 3/4-inch wood strip flooring is installed at right angles to joist.

h. Span is permitted to be 24 inches on center for floors where 1 1/2 inches of cellular or lightweight concrete is applied over the panels.

TABLE 2304.8(4)—ALLOWABLE SPAN FOR WOOD STRUCTURAL PANEL COMBINATION SUBFLOOR-UNDERLAYMENT (SINGLE FLOOR)[a] (Panels Continuous Over Two or More Spans and Strength Axis Perpendicular to Supports)

IDENTIFICATION	MAXIMUM SPACING OF JOISTS (inches)				
	16	20	24	32	48
Species group[b]	Thickness (inches)				
1	1/2	5/8	3/4	—	—
2, 3	5/8	3/4	7/8	—	—
4	3/4	7/8	1	—	—
Single floor span rating[c]	16 o.c.	20 o.c.	24 o.c.	32 o.c.	48 o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Spans limited to value shown because of possible effects of concentrated loads. Allowable uniform loads based on deflection of 1/360 of span is 100 pounds per square foot except allowable total uniform load for 1 1/8-inch wood structural panels over joists spaced 48 inches on center is 65 pounds per square foot. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless 1/4-inch minimum thickness underlayment or 1 1/2 inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is 3/4-inch wood strip.

b. Applicable to all grades of sanded exterior-type plywood. See DOC PS 1 for plywood species groups.

c. Applicable to underlayment grade, C-C (plugged) plywood, and single floor grade wood structural panels.

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TABLE 2304.8(5)—ALLOWABLE LOAD (PSF) FOR WOOD STRUCTURAL PANEL ROOF SHEATHING CONTINUOUS OVER TWO OR MORE SPANS AND STRENGTH AXIS PARALLEL TO SUPPORTS (Plywood structural panels are five-ply, five-layer unless otherwise noted)[a]

PANEL GRADE	THICKNESS (inch)	MAXIMUM SPAN (inches)	LOAD AT MAXIMUM SPAN (psf)	
			Live	Total[c]
Structural I sheathing	7/16	24	20	30
	15/32	24	35[b]	45[b]
	1/2	24	40[b]	50[b]
	19/32, 5/8	24	70	80
	23/32, 3/4	24	90	100
Sheathing, other grades covered in DOC PS 1 or DOC PS 2	7/16	16	40	50
	15/32	24	20	25
	1/2	24	25	30
	19/32	24	40[b]	50[b]
	5/8	24	45[b]	55[b]
	23/32, 3/4	24	60[b]	65[b]

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Uniform load deflection limitations 1/180 of span under live load plus dead load, 1/240 under live load only. Edges shall be blocked with lumber or other approved type of edge supports.

b. For composite and four-ply plywood structural panel, load shall be reduced by 15 pounds per square foot.

c. Where the total load includes snow, use allowable stress design snow loads.

2304.8.1 Structural floor sheathing. Structural floor sheathing shall be designed in accordance with the general provisions of this code.

Floor sheathing conforming to the provisions of Table 2304.8(1), 2304.8(2), 2304.8(3) or 2304.8(4) shall be deemed to meet the requirements of this section.

2304.8.2 Structural roof sheathing. Structural roof sheathing shall be designed in accordance with the general provisions of this code and the special provisions in this section.

Roof sheathing conforming to the provisions of Table 2304.8(1), 2304.8(2), 2304.8(3) or 2304.8(5) shall be deemed to meet the requirements of this section. Wood structural panel roof sheathing shall be of a type manufactured with exterior glue (Exposure 1 or Exterior).

2304.9 Lumber decking. Lumber decking shall be designed and installed in accordance with the general provisions of this code and Sections 2304.9.1 through 2304.9.5.3. Other lumber decking patterns and connection designs shall be substantiated through engineering analysis.

2304.9.1 General. Each piece of lumber decking shall be square-end trimmed. Where random lengths are furnished, each piece shall be square end trimmed across the face so that not less than 90 percent of the pieces are within 0.5 degrees (0.00873 rad) of square. The ends of the pieces shall be permitted to be beveled up to 2 degrees (0.0349 rad) from the vertical with the exposed face of the piece slightly longer than the opposite face of the piece. Tongue-and-groove decking shall be installed with the tongues up on sloped or pitched roofs with pattern faces down.

2304.9.2 Layup patterns. Lumber decking is permitted to be laid up following one of five standard patterns as defined in Sections 2304.9.2.1 through 2304.9.2.5.

2304.9.2.1 Simple span pattern. All pieces shall be supported on their ends (in other words, by two supports).

2304.9.2.2 Two-span continuous pattern. All pieces shall be supported by three supports, and all end joints shall occur in line on alternating supports. Supporting members shall be designed to accommodate the load redistribution caused by this pattern.

2304.9.2.3 Combination simple and two-span continuous pattern. Courses in end spans shall be alternating simple-span pattern and two-span continuous pattern. End joints shall be staggered in adjacent courses and shall bear on supports.

2304.9.2.4 Cantilevered pieces intermixed pattern. The decking shall extend across not fewer than three spans. Pieces in each starter course and every third course shall be simple span pattern. Pieces in other courses shall be cantilevered over the supports with end joints at alternating quarter or third points of the spans. Each piece shall bear on one support or more.

2304.9.2.5 Controlled random pattern. The decking shall extend across not fewer than three spans. End joints of pieces within 6 inches (152 mm) of the end joints of the adjacent pieces in either direction shall be separated by not fewer than two intervening courses. In the end bays, each piece shall bear on one support or more. Where an end joint occurs in an end bay, the next piece in the same course shall continue over the first inner support for not less than 24 inches (610 mm). The details of the controlled random pattern shall be as specified for each decking material in Section 2304.9.3.3, 2304.9.4.3 or 2304.9.5.3.

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Decking that cantilevers beyond a support for a horizontal distance greater than 18 inches (457 mm), 24 inches (610 mm) or 36 inches (914 mm) for 2-inch (51 mm), 3-inch (76 mm) and 4-inch (102 mm) nominal thickness decking, respectively, shall comply with the following:

1. The maximum cantilevered length shall be 30 percent of the length of the first adjacent interior span.
2. A structural fascia shall be fastened to each decking piece to maintain a continuous, straight line.
3. End joints shall not be in the decking between the cantilevered end of the decking and the centerline of the first adjacent interior span.

2304.9.3 Mechanically laminated decking. Mechanically laminated decking shall comply with Sections 2304.9.3.1 through 2304.9.3.3.

2304.9.3.1 General. Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.

2304.9.3.2 Nailing. The length of nails connecting laminations shall be not less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center or less, side nails shall be installed not more than 30 inches (762 mm) on center alternating between top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) on center, side nails shall be installed not more than 18 inches (457 mm) on center alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, nailing in accordance with Table 2304.9.3.2 shall be permitted. Two side nails shall be installed at each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) on center, alternate laminations shall be toenailed to every support. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, toenailing in accordance with Table 2304.9.3.2 shall be permitted.

TABLE 2304.9.3.2—FASTENING SCHEDULE FOR MECHANICALLY LAMINATED DECKING USING LAMINATIONS OF 2-INCH NOMINAL THICKNESS

MINIMUM NAIL SIZE (Length x Diameter) (inches)	MAXIMUM SPACING BETWEEN FACE NAILS [a, b] (inches)		NUMBER OF TOENAILS INTO SUPPORTS[c]
	Decking Supports ≤ 48 inches o.c.	Decking Supports > 48 inches o.c.	
4 × 0.192	30	18	1
4 × 0.162	24	14	2
4 × 0.148	22	13	2
$3^1/_2$ × 0.162	20	12	2
$3^1/_2$ × 0.148	19	11	2
$3^1/_2$ × 0.135	17	10	2
3 × 0.148	11	7	2
3 × 0.128	9	5	2
$2^3/_4$ × 0.148	10	6	2
$2^3/_4$ × 0.131	9	6	3
$2^3/_4$ × 0.120	8	5	3

For SI: 1 inch = 25.4 mm

a. Nails shall be driven perpendicular to the lamination face, alternating between top and bottom edges.

b. Where nails penetrate through two laminations and into the third, they shall be staggered one-third of the spacing in adjacent laminations. Otherwise, nails shall be staggered one-half of the spacing in adjacent laminations.

c. Where supports are 48 inches on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches on center, alternate laminations shall be toenailed to every support.

2304.9.3.3 Controlled random pattern. There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

2304.9.4 Two-inch sawn tongue-and-groove decking. Two-inch (51 mm) sawn tongue-and-groove decking shall comply with Sections 2304.9.4.1 through 2304.9.4.3.

2304.9.4.1 General. Two-inch (51 mm) decking shall have a maximum moisture content of 15 percent. Decking shall be machined with a single tongue-and-groove pattern. Each decking piece shall be nailed to each support.

2304.9.4.2 Nailing. Each piece of decking shall be toenailed at each support with one 16d common nail through the tongue and face-nailed with one 16d common nail.

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2304.9.4.3 Controlled random pattern. There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

2304.9.5 Three- and four-inch sawn tongue-and-groove decking. Three- and four-inch (76 mm and 102 mm) sawn tongue-and-groove decking shall comply with Sections 2304.9.5.1 through 2304.9.5.3.

2304.9.5.1 General. Three-inch (76 mm) and four-inch (102 mm) decking shall have a maximum moisture content of 19 percent. Decking shall be machined with a double tongue-and-groove pattern. Decking pieces shall be interconnected and nailed to the supports.

2304.9.5.2 Nailing. Each piece shall be toenailed at each support with one 40d common nail and face-nailed with one 60d common nail. Courses shall be spiked to each other with 8-inch (203 mm) spikes at maximum intervals of 30 inches (762 mm) through predrilled edge holes penetrating to a depth of approximately 4 inches (102 mm). One spike shall be installed at a distance not exceeding 10 inches (254 mm) from the end of each piece.

2304.9.5.3 Controlled random pattern. There shall be a minimum distance of 48 inches (1219 mm) between end joints in adjacent courses. Pieces not bearing on a support are permitted to be located in interior bays provided that the adjacent pieces in the same course continue over the support for not less than 24 inches (610 mm). This condition shall not occur more than once in every six courses in each interior bay.

2304.10 Connectors and fasteners. Connectors and fasteners shall comply with the applicable provisions of Sections 2304.10.1 through 2304.10.8.

2304.10.1 Fire protection of connections. Connections used with fire-resistance-rated members and in fire-resistance-rated assemblies of Type IV-A, IV-B, or IV-C construction shall be protected for the time associated with the fire-resistance rating. Protection time shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C), and a maximum temperature rise of 325°F (181°C), for a time corresponding to the required fire-resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners, and portions of wood members included in the structural design of the connection.

2304.10.2 Fastener requirements. Connections for wood members shall be designed in accordance with the appropriate methodology in Section 2302.1. The number and size of fasteners connecting wood members shall be not less than that set forth in Table 2304.10.2.

TABLE 2304.10.2—FASTENING SCHEDULE

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[g]	SPACING AND LOCATION
Roof		
1. Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box ($2^1/_2$″ x 0.113″); or 3-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 3-3″14 gage staples, $^7/_{16}$″ crown	Each end, toenail
Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common ($2^1/_2$″ × 0.131″) 2-3″ × 0.131″ nails 2-3″ 14 gage staples	Each end, toenail
	2-16 d common ($3^1/_2$″ × 0.162″) 3-3″ × 0.131″ nails 3-3″ 14 gage staples	End nail
Flat blocking to truss and web filler	16d common ($3^1/_2$″ × 0.162″) @ 6″ o.c. 3″ × 0.131″ nails @ 6″ o.c. 3″ × 14 gage staples @ 6″ o.c	Face nail
2. Ceiling joists to top plate	4-8d box ($2^1/_2$″ x 0.113″); or 3-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^7/_{16}$″ crown	Each joist, toenail
3. Ceiling joist not attached to parallel rafter, laps over partitions (no thrust) (see Section 2308.11.3.1, Table 2308.11.3.1)	3-16d common ($3^1/_2$″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-3″ 14 gage staples, $^7/_{16}$″ crown	Face nail
4. Ceiling joist attached to parallel rafter (heel joint) (see Section 2308.11.3.1, Table 2308.11.3.1)	Per Table 2308.11.3.1	Face nail

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TABLE 2304.10.2—FASTENING SCHEDULE—continued		
DESCRIPTION OF BUILDING ELEMENTS	**NUMBER AND TYPE OF FASTENER[g]**	**SPACING AND LOCATION**
5. Collar tie to rafter	3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-3″ 14 gage staples, $^{7}/_{16}$″ crown	Face nail
6. Rafter or roof truss to top plate (See Section 2308.11.4, Table 2308.11.4)	3-10 common (3″ × 0.148″); or 3-16d box ($3^{1}/_{2}$″ × 0.135″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131 nails; or 4-3″ 14 gage staples, $^{7}/_{16}$″ crown	2 toenails on one side and 1 toenail on opposite side of rafter or truss[c]
7. Roof rafters to ridge valley or hip rafters; or roof rafter to 2-inch ridge beam	2-16d common ($3^{1}/_{2}$″ × 0.162″); or 3-16d box ($3^{1}/_{2}$″ × 0.135″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^{7}/_{16}$″ crown	End nail
	3-10d common ($3^{1}/_{2}$″ × 0.148″); or 4-16d box ($3^{1}/_{2}$″ × 0.135″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-3″ 14 gage staples, $^{7}/_{16}$″ crown	Toenail
Wall		
8. Stud to stud (not at braced wall panels)	16d common ($3^{1}/_{2}$″ × 0.162″);	24″ o.c. face nail
	10d box (3″ × 0.128″); or 3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^{7}/_{16}$″ crown	16″ o.c. face nail
9. Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d common ($3^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
	16d box ($3^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^{7}/_{16}$″ crown	12″ o.c. face nail
10. Built-up header (2″ to 2″ header)	16d common ($3^{1}/_{2}$″ × 0.162″)	16″ o.c. each edge, face nail
	16d box ($3^{1}/_{2}$″ × 0.135″)	12″ o.c. each edge, face nail
11. Continuous header to stud	4-8d common ($2^{1}/_{2}$″ × 0.131″); or 4-10d box (3″ × 0.128″); or 5-8d box ($2^{1}/_{2}$″ x 0.113″)	Toenail
12. Top plate to top plate	16d common ($3^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
	10d box (3″ × 0.128″); or 3″ × 0.131″ nails; or 3″ 14 gage staples, $^{7}/_{16}$″ crown	12″ o.c. face nail
13. Top plate to top plate, at end joints	8-16d common ($3^{1}/_{2}$″ × 0.162″); or 12-16d box ($3^{1}/_{2}$″ x 0.135″); or 12-10d box (3″ × 0.128″); or 12-3″ × 0.131″ nails; or 12-3″ 14 gage staples, $^{7}/_{16}$″ crown	Each side of end joint, face nail (minimum 24" lap splice length each side of end joint)
14. Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common ($3^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
	16d box ($3^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails; or 3″ 14 gage staples, $^{7}/_{16}$″ crown	12″ o.c. face nail
15. Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	2-16d common ($3^{1}/_{2}$″ × 0.162″); or 3-16d box ($3^{1}/_{2}$″ × 0.135″); or 4-3″ × 0.131″ nails; or 4-3″ 14 gage staples, $^{7}/_{16}$″ crown	16″ o.c. face nail

TABLE 2304.10.2—FASTENING SCHEDULE—continued		
DESCRIPTION OF BUILDING ELEMENTS	**NUMBER AND TYPE OF FASTENER[g]**	**SPACING AND LOCATION**
16. Stud to top or bottom plate	3-16d box ($3^1/_2$″ x 0.135″); or 4-8d common ($2^1/_2$″ × 0.131″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-8d box ($2^1/_2$″ x 0.113″); or 4-3″ 14 gage staples, $^7/_{16}$″ crown	Toenail
	2-16d common ($3^1/_2$″ × 0.162″); or 3-16d box ($3^1/_2$″ x 0.135″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^7/_{16}$″ crown	End nail
17. Top plates, laps at corners and intersections	2-16d common ($3^1/_2$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^7/_{16}$″ crown	Face nail
18. 1″ brace to each stud and plate	3-8d box ($2^1/_2$″ x 0.113″); or 2-8d common ($2^1/_2$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2-3″ × 0.131″ nails; or 2-3″ 14 gage staples, $^7/_{16}$″ crown	Face nail
19. 1″ × 6″ sheathing to each bearing	3-8d box ($2^1/_2$″ x 0.113″); or 2-8d common ($2^1/_2$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2-$1^3/_4$″ 16 gage staples, 1″ crown	Face nail
20. 1″ × 8″ and wider sheathing to each bearing	3-8d common ($2^1/_2$″ × 0.131″); or 3-8d box ($2^1/_2$″ x 0.113″); or 3-10d box (3″ × 0.128″); or 3-$1^3/_4$″ 16 gage staples, 1″ crown	Face nail
	Wider than 1″ × 8″ 3-8d common ($2^1/_2$″ x 0.131″); or 4-8d box ($2^1/_2$″ × 0.113″); or 3-10d box (3″ × 0.128″); or 4-$1^3/_4$″ 16 gage staples, 1″ crown	
Floor		
21. Joist to sill, top plate, or girder	4-8d box ($2^1/_2$″ × 0.113″); or 3-8d common ($2^1/_2$″ × 0.131″); or floor 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^7/_{16}$″ crown	Toenail
22. Rim joist, band joist, or blocking to top plate, sill or other framing below	8d box ($2^1/_2$″ × 0.113″)	4″ o.c., toenail
	8d common ($2^1/_2$″ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails; or 3″ 14 gage staples, $^7/_{16}$″ crown	6″ o.c., toenail
23. 1″ × 6″ subfloor or less to each joist	3-8d box ($2^1/_2$″ × 0.113″); or 2-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 2-$1^3/_4$″ 16 gage staples, 1″ crown	Face nail
24. 2 subfloor to joist or girder	3-16d box ($3^1/_2$″ × 0.135″); or 2-16d common ($3^1/_2$″ × 0.162″)	Blind and face nail
25. 2″ planks (plank & beam – floor & roof)	3-16d box ($3^1/_2$″ × 0.135″); or 2-16d common ($3^1/_2$″ × 0.162″)	Each bearing, face nail

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TABLE 2304.10.2—FASTENING SCHEDULE—continued			
DESCRIPTION OF BUILDING ELEMENTS	**NUMBER AND TYPE OF FASTENER[g]**	**SPACING AND LOCATION**	
26. Built-up girders and beams, 2″ lumber layers	20d common (4″ × 0.192″)	32″ o.c., face nail at top and bottom staggered on opposite sides	
	10d box (3″ × 0.128″); or 3″ × 0.131″ nails; or 3″ 14 gage staples, $^{7}/_{16}$″ crown	24″ o.c. face nail at top and bottom staggered on opposite sides	
	And: 2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 3-3″ 14 gage staples, $^{7}/_{16}$″ crown	Ends and at each splice, face nail	
27. Ledger strip supporting joists or rafters	3-16d common ($3^{1}/_{2}$″ × 0.162″); or 4-16d box ($3^{1}/_{2}$″ × 0.135″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-3″ 14 gage staples, $^{7}/_{16}$″ crown	Each joist or rafter, face nail	
28. Joist to band joist or rim joist	3-16d common ($3^{1}/_{2}$″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-3″ 14 gage staples, $^{7}/_{16}$″ crown	End nail	
29. Bridging or blocking to joist, rafter or truss	2-8d common ($2^{1}/_{2}$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2-3″ × 0.131″ nails; or 2-3″ 14 gage staples, $^{7}/_{16}$″ crown	Each end, toenail	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing[a]			
		Edges (inches)	**Intermediate supports (inches)**
30. $^{3}/_{8}$″ – $^{1}/_{2}$″	6d common or deformed (2″ × 0.113″); or $2^{3}/_{8}$″ × 0.113″ nail (subfloor and wall)	6	12
	8d common or deformed ($2^{1}/_{2}$″ × 0.131″ × 0.281″ head) nail (roof); or RSRS-01 ($2^{3}/_{8}$″ × 0.113″ × 0.281″ head) nail (roof)[d]	6[e]	6[e]
	$1^{3}/_{4}$″ 16 gage staple, $^{7}/_{16}$″ crown (subfloor and wall)	4	8
	$2^{3}/_{8}$″ × 0.113″× 0.266″ head nail (roof)	3[f]	3[f]
	$1^{3}/_{4}$″ 16 gage staple, $^{7}/_{16}$″ crown (roof)	3[f]	3[f]
31. $^{19}/_{32}$″ – $^{3}/_{4}$″	8d common ($2^{1}/_{2}$″ × 0.131″); or deformed (2″ × 0.113″) (subfloor and wall)	6	12
	8d common or deformed ($2^{1}/_{2}$″ × 0.131″ × 0.281″ head) nail (roof); or RSRS-01 ($2^{3}/_{8}$″ × 0.113″ × 0.281″ head) nail (roof)[d]	6[e]	6[e]
	$2^{3}/_{8}$″ × 0.113″× 0.266″ head nail; or 2″ 16 gage staple, $^{7}/_{16}$″ crown (subfloor and wall)	4	8
32. $^{7}/_{8}$″ – $1^{1}/_{4}$″	10d common (3″ × 0.148″); or deformed ($2^{1}/_{2}$″ × 0.131″ × 0.281″ head)	6	12
Other exterior wall sheathing			
33. $^{1}/_{2}$″ fiberboard sheathing[b]	$1^{1}/_{2}$″ × 0.120″, galvanized roofing nail ($^{7}/_{16}$″ head diameter); or $1^{1}/_{4}$″ 16 gage staple with $^{7}/_{16}$″ or 1″ crown	3	6
34. $^{25}/_{32}$″ fiberboard sheathing[b]	$1^{3}/_{4}$″ × 0.120″ galvanized roofing nail ($^{7}/_{16}$″ diameter head); or $1^{1}/_{2}$″ 16 gage staple with $^{7}/_{16}$″ or 1″ crown	3	6

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TABLE 2304.10.2—FASTENING SCHEDULE—continued			
DESCRIPTION OF BUILDING ELEMENTS	**NUMBER AND TYPE OF FASTENER[g]**	**SPACING AND LOCATION**	
Wood structural panels, combination subfloor underlayment to framing			
35. $^{3}/_{4}$″ and less	8d common ($2^{1}/_{2}$″ × 0.131″); or deformed (2″ × 0.113″); or deformed (2″ × 0.120″)	6	12
36. $^{7}/_{8}$″ – 1″	8d common ($2^{1}/_{2}$″ × 0.131″); or deformed ($2^{1}/_{2}$″ × 0.131″); or deformed ($2^{1}/_{2}$″ × 0.120″)	6	12
37. $1^{1}/_{8}$″ – $1^{1}/_{4}$″	10d common (3″ × 0.148″); or deformed ($2^{1}/_{2}$″ × 0.131″); or deformed ($2^{1}/_{2}$″ × 0.120")	6	12
Panel siding to framing			
38. $^{1}/_{2}$″ or less	6d corrosion-resistant siding ($1^{7}/_{8}$″ × 0.106″); or 6d corrosion-resistant casing (2″ × 0.099″)	6	12
39. $^{5}/_{8}$″	8d corrosion-resistant siding ($2^{3}/_{8}$″ × 0.128″); or 8d corrosion-resistant casing ($2^{1}/_{2}$″ × 0.113″)	6	12
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing[a]			
		Edges (inches)	**Intermediate supports (inches)**
Interior paneling			
40. $^{1}/_{4}$″	4d casing ($1^{1}/_{2}$″ × 0.080″); or 4d finish ($1^{1}/_{2}$″ × 0.072″)	6	12
41. $^{3}/_{8}$″	6d casing (2″ × 0.099″); or 6d finish (2″ × 0.092″) (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

a. Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.

b. Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).

c. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.

d. RSRS is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

e. Tabulated fastener requirements apply where the basic wind speed, *V*, is less than 140 mph. For wood structural panel roof sheathing attached to gable-end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the basic wind speed, *V*, is greater than 130 mph in Exposure B or greater than 110 mph in Exposure C. Spacing exceeding 6 inches on center at intermediate supports shall be permitted where the fastening is designed per the AWC NDS. Where the specific gravity of the wood species used for roof framing is greater than or equal to 0.35 but less than 0.42 in accordance with AWC NDS, fastening of roof sheathing shall be with RSRS-03 ($2^{1}/_{2}$″ × 0.131″ × 0.281″ head) nails unless alternative fastening is designed in accordance with AWC NDS. Where the specific gravity of the wood species used for roof framing is less than 0.35, fastening of the roof sheathing shall be designed in accordance with AWC NDS.

f. Fastening is only permitted where the basic wind speed, *V*, is less than or equal to 110 mph and where fastening is to wood framing of a species with specific gravity greater than or equal to 0.42 in accordance with AWC NDS.

g. Nails and staples are carbon steel meeting the specifications of ASTM F1667. Connections using nails and staples of other materials, such as stainless steel, shall be designed by acceptable engineering practice or approved under Section 104.2.3.

2304.10.2.1 Additional requirements. [DSA-SS and OSHPD 1, 1R, 2, 4 & 5] *Fasteners used for the attachment of exterior wall coverings shall be of hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.*

2304.10.3 Sheathing fasteners. Sheathing nails or other approved sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

2304.10.4 Joist hangers and framing anchors. Connections depending on joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered are permitted where approved. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with ASTM D7147.

2304.10.5 Other fasteners. Clips, staples, glues and other approved methods of fastening are permitted where approved.

2304.10.6 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners, including nuts and washers, and connectors in contact with preservative-treated and fire-retardant-treated wood shall be in accordance with Sections 2304.10.6.1 through 2304.10.6.4. The coating weights for zinc-coated fasteners shall be in accordance

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with ASTM A153. The coating weight for zinc-coated nails shall be in accordance with ASTM A153 Class D or ASTM A641 Class 3S [1 ounce per square foot (305 g/m^2)]. Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F1667.

2304.10.6.1 Fasteners and connectors for preservative-treated wood. Fasteners, including nuts and washers, in contact with preservative-treated wood shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum. Connectors that are used in exterior applications and in contact with preservative-treated wood shall have coating types and weights in accordance with the treated wood or connector manufacturer's recommendations. In the absence of manufacturer's recommendations, not less than ASTM A653, Type G185 zinc-coated galvanized steel, or equivalent, shall be used.

Exception: Plain carbon steel fasteners, including nuts and washers, in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

2304.10.6.2 Fastenings for wood foundations. Fastenings, including nuts and washers, for wood foundations shall be as required in AWC PWF.

2304.10.6.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations. Fasteners, including nuts and washers, for fire-retardant-treated wood used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum.

2304.10.6.4 Fasteners for fire-retardant-treated wood used in interior applications. Fasteners, including nuts and washers, for fire-retardant-treated wood used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, Section 2304.10.6.3 shall apply.

2304.10.7 Load path. Where wall framing members are not continuous from the foundation sill to the roof, the members shall be secured to ensure a continuous load path. Where required, sheet metal clamps, ties or clips shall be formed of galvanized steel or other approved corrosion-resistant material not less than 0.0329-inch (0.836 mm) base metal thickness.

2304.10.8 Framing requirements. Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive loads, neglecting end-bearing capacity. Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

2304.11 Heavy timber construction. Where a structure, portion thereof or individual structural elements are required by provisions of this code to be of heavy timber, the building elements therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimensions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or in Sections 2304.11.2 through 2304.11.4. Lumber decking shall be in accordance with Section 2304.9.

TABLE 2304.11—MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS

		MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	$6^3/_4$	$8^1/_4$	7	$7^1/_2$
	Wood beams and girders	6	10	5	$10^1/_2$	$5^1/_4$	$9^1/_2$
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	$8^1/_4$	$5^1/_4$	$7^1/_2$
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	$5^1/_4$	$5^1/_2$
	Framed timber trusses and other roof framing;[a] Framed or glued-laminated arches that spring from the top of walls or wall abutments	4[b]	6	3[b]	$6^7/_8$	$3^1/_2$[b]	$5^1/_2$

For SI: 1 inch = 25.4 mm.

a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.

b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width.

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2304.11.1 Details of heavy timber structural members. Heavy timber structural members shall be detailed and constructed in accordance with Sections 2304.11.1 through 2304.11.1.3.

2304.11.1.1 Columns. Minimum dimensions of columns shall be in accordance with Table 2304.11. Columns shall be connected in an approved manner. Columns shall be continuous or aligned vertically from floor to floor in all stories of Type IV-HT construction. Girders and beams at column connections shall be closely fitted around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal loads across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof loads only. Where traditional heavy timber detailing is used, connections shall be by means of reinforced concrete or metal caps with brackets, by properly designed steel or iron caps, with pintles and base plates, by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other approved methods.

2304.11.1.2 Floor framing. Minimum dimensions of floor framing shall be in accordance with Table 2304.11. Approved wall plate boxes or hangers shall be provided where wood beams, girders or trusses rest on masonry or concrete walls. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by an approved metal hanger into which the ends of the beams shall be closely fitted. Where traditional heavy timber detailing is used, these connections shall be permitted to be supported by ledgers or blocks securely fastened to the sides of the girders.

2304.11.1.3 Roof framing. Minimum dimensions of roof framing shall be in accordance with Table 2304.11. Every roof girder and not less than every alternate roof beam shall be anchored to its supporting member to resist forces as required in Chapter 16.

2304.11.2 Partitions and walls. Partitions and walls shall comply with Section 2304.11.2.1 or 2304.11.2.2.

2304.11.2.1 Exterior walls. Exterior walls shall be permitted to be cross-laminated timber not less than 4 inches (102 mm) in thickness meeting the requirements of Section 2303.1.4.

2304.11.2.2 Interior walls and partitions. Interior walls and partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction 4 inches (102 mm) thick, or of 1-hour fire-resistance-rated construction.

2304.11.3 Floors. Floors shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.3. Wood floors shall be constructed in accordance with Section 2304.11.3.1 or 2304.11.3.2.

2304.11.3.1 Cross-laminated timber floors. Cross-laminated timber shall be not less than 4 inches (102 mm) in thickness. Cross-laminated timber shall be continuous from support to support and mechanically fastened to one another. Cross-laminated timber shall be permitted to be connected to walls without a shrinkage gap providing swelling or shrinking is considered in the design. Corbelling of masonry walls under the floor shall be permitted to be used.

2304.11.3.2 Sawn or glued-laminated plank floors. Sawn or glued-laminated plank floors shall be one of the following:

1. Sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, $^{15}/_{32}$-inch (12 mm) wood structural panel or $^{1}/_{2}$-inch (12.7 mm) particleboard.
2. Planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or $^{15}/_{32}$-inch (12 mm) wood structural panel or $^{1}/_{2}$-inch (12.7 mm) particleboard.

The lumber shall be laid so that continuous lines of joints will occur only at points of support. Floors shall not extend closer than $^{1}/_{2}$ inch (12.7 mm) to walls. Such $^{1}/_{2}$-inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbelling of masonry walls under the floor shall be permitted to be used in place of molding.

2304.11.4 Roof decks. Roofs shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.3. Roof decks shall be constructed in accordance with Section 2304.11.4.1 or 2304.11.4.2. Other types of decking shall be an alternative that provides equivalent fire resistance and structural properties. Where supported by a wall, roof decks shall be anchored to walls to resist forces determined in accordance with Chapter 16. Such anchors shall consist of steel bolts, lags, screws or approved hardware of sufficient strength to resist prescribed forces.

2304.11.4.1 Cross-laminated timber roofs. Cross-laminated timber roofs shall be not less than 3 inches (76 mm) in thickness and shall be continuous from support to support and mechanically fastened to one another.

2304.11.4.2 Sawn, wood structural panel, or glued-laminated plank roofs. Sawn, wood structural panel, or glued-laminated plank roofs shall be one of the following:

1. Sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness.
2. $1^{1}/_{8}$-inch-thick (32 mm) wood structural panel (exterior glue).
3. Planks not less than 3 inches (76 mm) nominal in width, set on edge close together and laid as required for floors.

2304.12 Protection against decay and termites. Wood shall be protected from decay and termites in accordance with the applicable provisions of Sections 2304.12.1 through 2304.12.4.

2304.12.1 Locations requiring waterborne preservatives or naturally durable wood. Wood used above ground in the locations specified in Sections 2304.12.1.1 through 2304.12.1.5 shall be naturally durable wood or preservative-treated wood using waterborne preservatives, in accordance with AWPA U1 for above-ground use.

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2304.12.1.1 Joists, girders and subfloor. Wood joists or wood structural floors that are closer than 18 inches (457 mm) or wood girders that are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation shall be of naturally durable or preservative-treated wood.

2304.12.1.1.1 [SPCB] *There shall be a clearance of at least 18 inches (457 mm) between the underside of wood floor joists and the finished surface of the ground, and at least 12 inches (305 mm) between the underside of any other wood horizontal framing member and the finished surface of the ground. The ground underneath floor joists shall be leveled or smoothed off so as to maintain a reasonably even surface.*

Exception: *For purposes of structural pest control inspection, a minimum of 12 inches (305 mm) of clearance under-floor joists shall be considered adequate except that such clearance shall not be necessary where the subarea soil is of such a nature as to prevent excavation or where excavation would create a hazard from shifting soil or other causes.*

2304.12.1.2 Wood supported by exterior foundation walls. Wood framing members, including wood sheathing, that are in contact with exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or preservative-treated wood.

Exception: [DSA-SS and OSHPD 1, 1R, 2, 4 & 5] *At exterior walls where the earth is paved with an asphalt or concrete slab at least 18 inches (457 mm) wide and draining away from the building, the bottom of sills are permitted to be 6 inches (152 mm) above the top of such slab. Other equivalent means of termite and decay protection may be accepted by the enforcement agency.*

2304.12.1.3 Exterior walls below grade. Wood framing members and furring strips in direct contact with the interior of exterior masonry or concrete walls below grade shall be of naturally durable or preservative-treated wood.

2304.12.1.4 Sleepers and sills. Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or preservative-treated wood.

2304.12.1.4.1 Additional requirements. [DSA-SS and OSHPD 1, 1R, 2, 4 & 5] *Stud walls or partitions at shower or toilet rooms with more than two plumbing fixtures, excluding floor drains, and stud walls adjacent to unroofed paved areas shall rest on a concrete curb extending at least 6 inches (152 mm) above finished floor and pavement level.*

2304.12.1.5 Wood siding. Clearance between wood siding and earth on the exterior of a building shall be not less than 6 inches (152 mm) or less than 2 inches (51 mm) vertical from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather except where siding, sheathing and wall framing are of naturally durable or preservative-treated wood.

2304.12.2 Other locations. Wood used in the locations specified in Sections 2304.12.2.1 through 2304.12.2.8 shall be naturally durable wood or preservative-treated wood in accordance with AWPA U1. Preservative-treated wood used in interior locations shall be protected with two coats of urethane, shellac, latex epoxy or varnish unless waterborne preservatives are used. Prior to application of the protective finish, the wood shall be dried in accordance with the manufacturer's recommendations.

2304.12.2.1 Girder ends. The ends of wood girders entering exterior masonry or concrete walls shall be provided with a $^{1}/_{2}$-inch (12.7 mm) airspace on top, sides and end, unless naturally durable or preservative-treated wood is used.

2304.12.2.2 Posts or columns. Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of naturally durable or preservative-treated wood.

Exception: Posts or columns that meet all of the following:

1. Are not exposed to the weather, or are protected by a roof, eave, overhang, or other covering if exposed to the weather.
2. Are supported by concrete piers or metal pedestals projected not less than 1 inch (25 mm) above the slab or deck and are separated from the concrete pier by an impervious moisture barrier.
3. Are located not less than 8 inches (203 mm) above exposed earth.

2304.12.2.3 Supporting member for permanent appurtenances. Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.

Exception: Sawn lumber in buildings located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use durable materials where the structure is exposed to the weather.

2304.12.2.4 Supporting members for permeable floors and roofs. Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood unless separated from such floors or roofs by an impervious moisture barrier. The impervious moisture barrier system protecting the structure supporting floors shall provide positive drainage of water that infiltrates the moisture-permeable floor topping.

2304.12.2.5 Ventilation beneath balcony or elevated walking surfaces. Enclosed framing in exterior balconies and elevated walking surfaces that have weather-exposed surfaces shall be provided with openings that provide a net free cross-ventilation area not less than $^{1}/_{150}$ of the area of each separate space.

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2304.12.2.6 Wood in contact with the ground or fresh water. Wood used in contact with exposed earth shall be naturally durable for both decay and termite resistance or preservative treated in accordance with AWPA U1 for soil or freshwater use.

Exception: Untreated wood is permitted where such wood is continuously and entirely below the ground-water level or submerged in fresh water.

2304.12.2.6.1 Posts or columns. Posts and columns that are supporting permanent structures and embedded in concrete that is exposed to the weather or in direct contact with the earth shall be of preservative-treated wood.

2304.12.2.7 Termite protection. In geographical areas where hazard of termite damage is known to be very heavy, wood floor framing in the locations specified in Section 2304.12.1.1 and exposed framing of exterior decks or balconies shall be of naturally durable species (termite resistant) or preservative treated in accordance with AWPA U1 for the species, product preservative and end use or provided with approved methods of termite protection.

2304.12.2.8 Wood used in retaining walls and cribs. Wood installed in retaining or crib walls shall be preservative treated in accordance with AWPA U1 for soil and freshwater use.

2304.12.3 Attic ventilation. For attic ventilation, see Section 1202.2.2.

2304.12.4 Under-floor ventilation (crawl space). For under-floor ventilation (crawl space), see Section 1202.4.

2304.12.8 Separate wood framing. [SPCB] *Correct the conditions in frame and stucco walls and similar appurtenant construction so that the wood framing is separate from the main structure by a complete concrete or masonry plug with no voids that will allow infestations to enter the structure from the wall. If there is no plug, the foundation shall be 2 inches (51 mm) or more above the grade levels and at least as high as the adjoining slabs or 4-inch (102 mm) concrete barrier seat off installed.*

2304.12.9 Earth fills. [SPCB] *Separate the earth fills such as under porches or paving from all woodwork by concrete, masonry, good quality cement plaster or other material approved by local building codes. Chemical treatment of earth fills is considered adequate if the foundation adjoining the fill meets standards of the current building codes.*

2304.13 Long-term loading. Wood members supporting concrete, masonry or similar materials shall be checked for the effects of long-term loading using the provisions of the ANSI/AWC NDS. The total deflection, including the effects of long-term loading, shall be limited in accordance with Section 1604.3.1 for these supported materials.

Exception: Horizontal wood members supporting masonry or concrete nonstructural floor or roof surfacing not more than 4 inches (102 mm) thick need not be checked for long-term loading.

SECTION 2305—GENERAL DESIGN REQUIREMENTS FOR LATERAL FORCE-RESISTING SYSTEMS

2305.1 General. Structures using wood shear walls or wood diaphragms to resist wind or seismic loads shall be designed and constructed in accordance with AWC SDPWS and the applicable provisions of Sections 2305, 2306 and 2307.

2305.1.1 Openings in shear panels. Openings in shear panels that materially affect their strength shall be detailed on the plans and shall have their edges adequately reinforced to transfer all shearing stresses.

2305.1.2 Permanent load duration. Permanent loads are associated with permanent load duration in accordance with the ANSI/AWC NDS. For wood shear walls and wood diaphragms designed to resist lateral loads of permanent load duration only and that are not in combination with wind or seismic lateral loads, the design unit shear capacities shall be taken as the AWC SDPWS nominal unit shear capacities, multiplied by 0.2 for use with allowable stress design in Section 2306 and 0.3 for use with load and resistance factor design in Section 2307.

2305.1.3 Additional requirements. [DSA-SS, DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] *See Section 2301.1.5 for modifications to AWC SDPWS.*

2305.2 Diaphragm deflection. The deflection of wood-frame diaphragms shall be determined in accordance with AWC SDPWS. The deflection (Δ_{dia}) of a blocked wood structural panel diaphragm uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-1. If not uniformly fastened, the constant 0.188 (For SI: 1/1627) in the third term shall be modified by an approved method.

Equation 23-1 $\Delta_{dia} = 5vL^3/8EAW + vL/4Gt + 0.188Le_n + \Sigma(x\Delta_c)/2W$

For SI: $\Delta_{dia} = 0.052vL^3/EAW + vL/4Gt + Le_n/1627 + \Sigma(x\Delta_c)/2W$

where:

A = Area of chord cross section, in square inches (mm^2).

E = Modulus of elasticity of diaphragm chords, in pounds per square inch (N/mm^2).

e_n = Staple slip, in inches (mm) [see Table 2305.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2(2)].

L = Diaphragm length (dimension perpendicular to the direction of the applied load), in feet (mm).

v = Induced unit shear in pounds per linear foot (plf) (N/mm).

W = Diaphragm width [in the direction of applied force, in feet (mm)].

x = Distance from chord splice to nearest support, in feet (mm).

Δ_c = Diaphragm chord splice slip at the induced unit shear, in inches (mm).

Δ_{dia} = Maximum mid-span diaphragm deflection determined by elastic analysis, in inches (mm).

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TABLE 2305.2(1)—e_n VALUES (inches) FOR USE IN CALCULATING DIAPHRAGM AND SHEAR WALL DEFLECTION DUE TO FASTENER SLIP (Structural I)[a, c]	
LOAD PER FASTENER[b] (pounds)	FASTENER DESIGNATIONS
	14-Ga staple × 2 inches long
60	0.011
80	0.018
100	0.028
120	0.04
140	0.053
160	0.068

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

a. Increase e_n values 20 percent for plywood grades other than Structural I.

b. Load per fastener = maximum shear per foot divided by the number of fasteners per foot at interior panel edges.

c. Decrease e_n values 50 percent for seasoned lumber (moisture content < 19 percent).

TABLE 2305.2(2)—VALUES OF *Gt* FOR USE IN CALCULATING DEFLECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS AND DIAPHRAGMS									
PANEL TYPE	SPAN RATING	VALUES OF *Gt* (lb/in. panel depth or width)							
		Structural Sheathing				Structural I			
		Plywood			OSB	Plywood			OSB
		3-ply	4-ply	5-ply[a]		3-ply	4-ply	5-ply[a]	
Sheathing	24/0	25,000	32,500	37,500	77,500	32,500	42,500	41,500	77,500
	24/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	32/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	40/20	28,500	37,000	43,000	88,500	37,000	48,000	47,500	88,500
	48/24	31,000	40,500	46,500	96,000	40,500	52,500	51,000	96,000
Single Floor	16 o.c.	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	20 o.c.	28,000	36,500	42,000	87,000	36,500	47,500	46,000	87,000
	24 o.c.	30,000	39,000	45,000	93,000	39,000	50,500	49,500	93,000
	32 o.c.	36,000	47,000	54,000	110,000	47,000	61,000	59,500	110,000
	48 o.c.	50,500	65,500	76,000	155,000	65,500	85,000	83,500	155,000

		Structural Sheathing			Structural I		
	Thickness (in.)	A-A, A-C	Marine	All Other Grades	A-A, A-C	Marine	All Other Grades
Sanded Plywood	1/4	24,000	31,000	24,000	31,000	31,000	31,000
	11/32	25,500	33,000	25,500	33,000	33,000	33,000
	3/8	26,000	34,000	26,000	34,000	34,000	34,000
	15/32	38,000	49,500	38,000	49,500	49,500	49,500
	1/2	38,500	50,000	38,500	50,000	50,000	50,000
	19/32	49,000	63,500	49,000	63,500	63,500	63,500
	5/8	49,500	64,500	49,500	64,500	64,500	64,500
Sanded Plywood—continued	23/32	50,500	65,500	50,500	65,500	65,500	65,500
	3/4	51,000	66,500	51,000	66,500	66,500	66,500
	7/8	52,500	68,500	52,500	68,500	68,500	68,500
	1	73,500	95,500	73,500	95,500	95,500	95,500
	1 1/8	75,000	97,500	75,000	97,500	97,500	97,500

For SI: 1 inch = 25.4 mm, 1 pound/inch = 0.1751 N/mm.

a. 5-ply applies to plywood with five or more layers. For 5-ply plywood with three layers, use values for 4-ply panels.

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2305.3 Shear wall deflection. The deflection of wood-frame shear walls shall be determined in accordance with AWC SDPWS. The deflection (Δ_{sw}) of a blocked wood structural panel shear wall uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-2.

Equation 23-2 $\Delta_{sw} = 8vh^3/EAb + vh/4Gt + 0.75he_n + d_a h/b$

For SI: $\Delta_{sw} = vh^3/3EAb + vh/Gt + \frac{he_n}{407.6} + d_a h/b$

where:

A = Area of end-post cross section in square inches (mm^2).

b = Shear wall length, in feet (mm).

d_a = Total vertical elongation of wall anchorage system (such as fastener slip, device elongation, rod elongation) in inches (mm), at the induced unit shear in the shear wall (v).

E = Modulus of elasticity of end posts, in pounds per square inch (N/mm^2).

e_n = Staple slip, in inches (mm) [see Table 2305.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2(2)].

h = Shear wall height, in feet (mm).

v = Induced unit shear, in pounds per linear foot (N/mm).

Δ_{sw} = Maximum shear wall deflection determined by elastic analysis, in inches (mm).

SECTION 2306—ALLOWABLE STRESS DESIGN

2306.1 Allowable stress design. The design and construction of wood elements in structures using allowable stress design shall be in accordance with the applicable standards listed in Table 2306.1.

TABLE 2306.1—STANDARDS FOR DESIGN AND CONSTRUCTION OF WOOD ELEMENTS IN STRUCTURES USING ALLOWABLE STRESS DESIGN

STANDARDS PROMULGATOR	STANDARD	TITLE
American Wood Council		
	ANSI/AWC NDS	National Design Specification for Wood Construction
	SDPWS	Special Design Provisions for Wind and Seismic
American Society of Agricultural and Biological Engineers		
	ASABE EP 484.3	Diaphragm Design of Metal-clad, Wood-Frame Rectangular Buildings
	ASABE EP 486.3	Shallow Post and Pier Foundation Design
	ASABE EP 559.1	Design Requirements and Bending Properties for Mechanically Laminated Wood Assemblies
APA—The Engineered Wood Association		
	ANSI 117	Standard Specifications for Structural Glued Laminated Timber of Softwood Species
	ANSI A190.1	Structural Glued Laminated Timber
		Panel Design Specification
		Plywood Design Specification Supplement 1—Design & Fabrication of Plywood Curved Panel
		Plywood Design Specification Supplement 2—Design & Fabrication of Glued Plywood-lumber Beams
		Plywood Design Specification Supplement 3—Design & Fabrication of Plywood Stressed-skin Panels
		Plywood Design Specification Supplement 4—Design & Fabrication of Plywood Sandwich Panels
		Plywood Design Specification Supplement 5—Design & Fabrication of All-plywood Beams
	APA T300	Glulam Connection Details
	APA S560	Field Notching and Drilling of Glued Laminated Timber Beams
	APA S475	Glued Laminated Beam Design Tables
	APA X450	Glulam in Residential Construction
	APA X440	Product and Application Guide: Glulam
	APA R540	Builders Tips: Proper Storage and Handling of Glulam Beams
Truss Plate Institute, Inc.		
	TPI 1	National Design Standard for Metal Plate Connected Wood Truss Construction

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TABLE 2306.1—STANDARDS FOR DESIGN AND CONSTRUCTION OF WOOD ELEMENTS IN STRUCTURES USING ALLOWABLE STRESS DESIGN—continued		
STANDARDS PROMULGATOR	**STANDARD**	**TITLE**
West Coast Lumber Inspection Bureau		
	AITC 104	Typical Construction Details
	AITC 110	Standard Appearance Grades for Structural Glued Laminated Timber
	AITC 113	Standard for Dimensions of Structural Glued Laminated Timber
	AITC 119	Standard Specifications for Structural Glued Laminated Timber of Hardwood Species
	AITC 200	Inspection Manual

2306.1.1 Joists and rafters. The design of rafter spans is permitted to be in accordance with the AWC STJR.

2306.1.2 Plank and beam flooring. The design of plank and beam flooring is permitted to be in accordance with the AWC Wood Construction Data No. 4.

2306.1.3 Preservative-treated wood allowable stresses. The allowable unit stresses for preservative-treated wood conforming to AWPA U1 need not be adjusted for treatment, but are subject to other adjustments. Load duration factors greater than 1.6 shall not be used in the structural design of preservative-treated wood members.

2306.1.4 Fire-retardant-treated wood allowable stresses. The allowable unit stresses for fire-retardant-treated wood, including connection design values, shall be developed in accordance with the provisions of Section 2303.2.6. Load duration factors greater than 1.6 shall not be used in the structural design of fire-retardant-treated wood members.

2306.1.5 Lumber decking. The capacity of lumber decking arranged according to the patterns described in Section 2304.9.2 shall be the lesser of the capacities determined for moment and deflection according to the formulas in Table 2306.1.5.

TABLE 2306.1.5—ALLOWABLE LOADS FOR LUMBER DECKING		
PATTERN	**ALLOWABLE AREA LOAD[a]**	
	Moment	**Deflection**
Simple span	$w_b = \frac{8F_b'd^2}{l^2 6}$	$w_\Delta = \frac{384\Delta E'd^3}{5l^4 12}$
Two-span continuous	$w_b = \frac{8F_b'd^2}{l^2 6}$	$w_\Delta = \frac{185\Delta E'd^3}{l^4 12}$
Combination simple- and two-span continuous	$w_b = \frac{8F_b'd^2}{l^2 6}$	$w_\Delta = \frac{131\Delta E'd^3}{l^4 12}$
Cantilevered pieces intermixed	$w_b = \frac{20F_b'd^2}{3l^2 6}$	$w_\Delta = \frac{105\Delta E'd^3}{l^4 12}$
Controlled random layup		
Mechanically laminated decking	$w_b = \frac{20F_b'd^2}{3l^2 6}$	$w_\Delta = \frac{100\Delta E'd^3}{l^4 12}$
2-inch decking	$w_b = \frac{20F_b'd^2}{3l^2 6}$	$w_\Delta = \frac{100\Delta E'd^3}{l^4 12}$
3-inch and 4-inch decking	$w_b = \frac{8F_b'd^2}{l^2 6}$	$w_\Delta = \frac{116\Delta E'd^3}{l^4 12}$

For SI: 1 inch = 25.4 mm.

a. w_b = Allowable total uniform load limited by moment.
w_Δ = Allowable total uniform load limited by deflection.
d = Actual decking thickness.
l = Span of decking.
F_b' = Allowable bending stress adjusted by applicable factors.
E' = Modulus of elasticity adjusted by applicable factors.

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2306.2 Wood-frame diaphragms. Wood-frame diaphragms shall be designed and constructed in accordance with AWC SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AWC SDPWS shall be met and the allowable shear values set forth in Table 2306.2(1) or 2306.2(2) shall be permitted. The allowable shear values in Tables 2306.2(1) and 2306.2(2) are permitted to be increased 40 percent for wind design.

TABLE 2306.2(1)—ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS UTILIZING STAPLES WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING[f]

PANEL GRADE	STAPLE LENGTH AND GAGE[d]	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES[e] (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					Fastener spacing (inches) at diaphragm boundaries (all cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5, 6)[b]				Fasteners spaced 6 inches max. at supported edges[b]	
					6	4	$2^1/_2$[c]	2[c]	Case 1 (No unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and 6)[g]
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4)[b]					
					6	6	4	3		
Structural I grades	$1^1/_2$ 16 gage	1	$^3/_8$	2	175	235	350	400	155	115
				3	200	265	395	450	175	130
			$^{15}/_{32}$	2	175	235	350	400	155	120
				3	200	265	395	450	175	130
Sheathing, single floor and other grades covered in DOC PS 1 and PS 2	$1^1/_2$ 16 gage	1	$^3/_8$	2	160	210	315	360	140	105
				3	180	235	355	400	160	120
			$^7/_{16}$	2	165	225	335	380	150	110
				3	190	250	375	425	165	125
			$^{15}/_{32}$	2	160	210	315	360	140	105
				3	180	235	355	405	160	120
			$^{19}/_{32}$	2	175	235	350	400	155	115
				3	200	265	395	450	175	130

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of lumber in ANSI/AWC NDS. (2) For staples find shear value from table for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.

b. Space fasteners maximum 12 inches on center along intermediate framing members (6 inches on center where supports are spaced 48 inches on center).

c. Framing at adjoining panel edges shall be 3 inches nominal or wider.

d. Staples shall have a minimum crown width of $^7/_{16}$ inch and shall be installed with their crowns parallel to the long dimension of the framing members.

e. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.

f. For shear loads of normal or permanent load duration as defined by the ANSI/AWC NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.

g. For Case 1 through 6 descriptions see Figure 2306.2(1).

FIGURE 2306.2(1)—CASES 1 THROUGH 6 FOR USE WITH TABLE 2306.2(1)

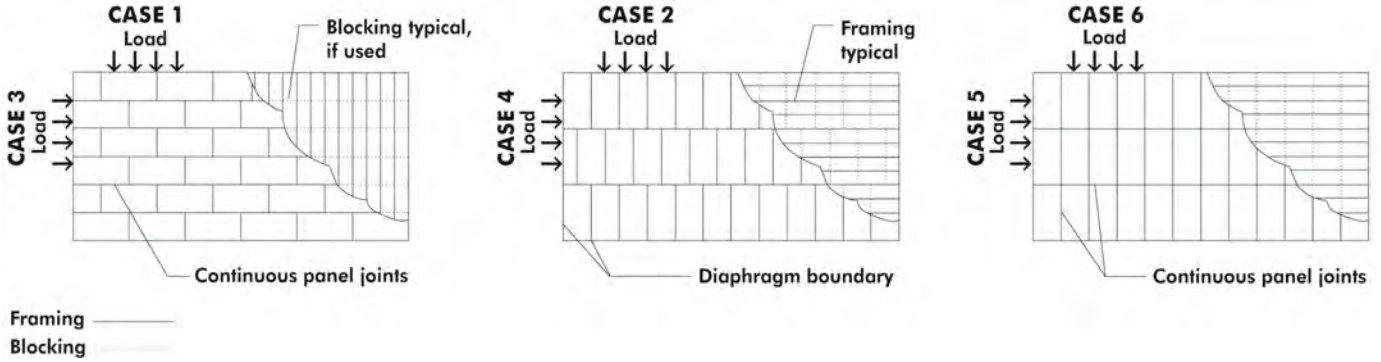

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TABLE 2306.2(2)—ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL BLOCKED DIAPHRAGMS UTILIZING MULTIPLE ROWS OF STAPLES (HIGH-LOAD DIAPHRAGMS) WITH FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING[b, g, h]

PANEL GRADE[c]	STAPLE GAGE[f]	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER AT ADJOINING PANEL EDGES AND BOUNDARIES[e]	LINES OF FASTENERS	BLOCKED DIAPHRAGMS					
						Cases 1 and 2[d]					
						Fastener Spacing Per Line at Boundaries (inches)[i]					
						4		$2^1/_2$		2	
						Fastener Spacing Per Line at Other Panel Edges (inches)[i]					
						6	4	4	3	3	2
Structural I grades	14 gage staples	2	$^{15}/_{32}$	3	2	600	600	860	960	1,060	1,200
				4	3	860	900	1,160	1,295	1,295	1,400
			$^{19}/_{32}$	3	2	600	600	875	960	1,075	1,200
				4	3	875	900	1,175	1,440	1,475	1,795
Sheathing single floor and other grades covered in DOC PS 1 and PS 2	14 gage staples	2	$^{15}/_{32}$	3	2	540	540	735	865	915	1,080
				4	3	735	810	1,005	1,105	1,105	1,195
			$^{19}/_{32}$	3	2	600	600	865	960	1,065	1,200
				4	3	865	900	1,130	1,430	1,370	1,485
			$^{23}/_{32}$	4	3	865	900	1,130	1,490	1,430	1,545

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of framing lumber in ANSI/AWC NDS. (2) For staples, find shear value from table for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.

b. Fastening along intermediate framing members: Space fasteners not greater than 12 inches on center, except 6 inches on center for spans greater than 32 inches.

c. Panels conforming to DOC PS 1 or PS 2.

d. This table gives shear values for Cases 1 and 2 as shown in Table 2306.2(1). The values shown are applicable to Cases 3, 4, 5 and 6 as shown in Table 2306.2(1), providing fasteners at all continuous panel edges are spaced in accordance with the boundary fastener spacing.

e. The minimum nominal depth of framing members shall be 3 inches nominal. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.

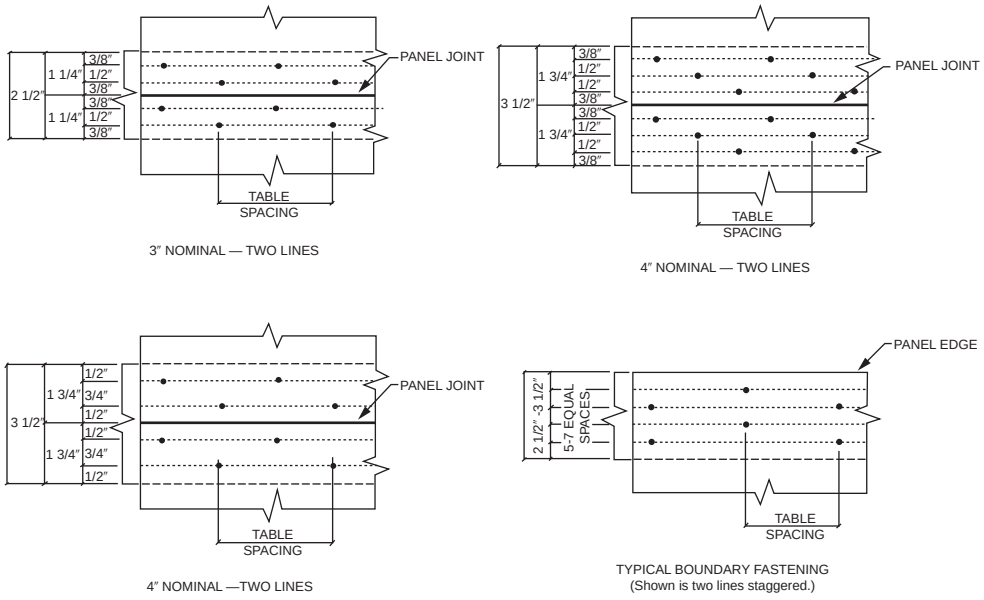
f. Staples shall have a minimum crown width of $^7/_{16}$ inch, and shall be installed with their crowns parallel to the long dimension of the framing members.

g. High-load diaphragms shall be subject to special inspection in accordance with Section 1705.5.1.

h. For shear loads of normal or permanent load duration as defined by the ANSI/AWC NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.

i. For fastener spacing diagrams see Figure 2306.2(2).

FIGURE 2306.2(2)—FASTENER SPACING DIAGRAMS FOR USE WITH TABLE 2306.2(2)



NOTE: SPACE PANEL END AND EDGE JOINT 1/8-INCH. REDUCE SPACING BETWEEN LINES OF NAILS AS NECESSARY TO MAINTAIN MINIMUM 3/8-INCH FASTENER EDGE MARGINS, MINIMUM SPACING BETWEEN LINES IS 3/8 INCH

For SI: 1 inch = 25.4 mm.

2306.2.1 Gypsum board diaphragm ceilings. Gypsum board diaphragm ceilings shall be in accordance with Section 2508.6.

2306.3 Wood-frame shear walls. Wood-frame shear walls shall be designed and constructed in accordance with AWC SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AWC SDPWS shall be met and the allowable shear values set forth in Table 2306.3(1), 2306.3(2) or 2306.3(3) shall be permitted. The allowable shear values in Tables 2306.3(1) and 2306.3(2) are permitted to be increased 40 percent for wind design. Panels complying with ANSI/APA PRP-210 shall be permitted to use design values for Plywood Siding in the AWC SDPWS.

TABLE 2306.3(1)—ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL SHEAR WALLS UTILIZING STAPLES WITH FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING[b, f, g, i]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING					PANELS APPLIED OVER 1/2" OR 5/8" GYPSUM SHEATHING				
			Staple length and gage[h] (inches)	Fastener spacing at panel edges (inches)				Staple length and gage[h] (inches)	Fastener spacing at panel edges (inches)			
				6	4	3	2[d]		6	4	3	2[d]
Structural I sheathing	3/8	1	1 1/2 16 Gage	155	235	315	400	2 16 Gage	155	235	310	400
	7/16			170	260	345	440		155	235	310	400
	15/32			185	280	375	475		155	235	300	400
Sheathing, plywood siding[e] except Group 5 Species, ANSI/APA PRP 210 siding[e]	5/16[c] or 1/4[c]	1	1 1/2 16 Gage	145	220	295	375	2 16 Gage	110	165	220	285
	3/8			140	210	280	360		140	210	280	360
	7/16			155	230	310	395		140	210	280	360
	15/32			170	255	335	430		140	210	280	360
	19/32		1 3/4 16 Gage	185	280	375	475	—	—	—	—	—

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of lumber in ANSI/AWC NDS. (2) For staples find shear value from table for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.

b. Panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space fasteners maximum 6 inches on center along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches on center. For other conditions and panel thickness, space fasteners maximum 12 inches on center on intermediate supports.

c. 3/8-inch panel thickness or siding with a span rating of 16 inches on center is the minimum recommended where applied directly to framing as exterior siding. For grooved panel siding, the nominal panel thickness is the thickness of the panel measured at the point of fastening.

d. Framing at adjoining panel edges shall be 3 inches nominal or wider.

e. Values apply to all-veneer plywood. Thickness at point of fastening on panel edges governs shear values.

f. Where panels are applied on both faces of a wall and fastener spacing is less than 6 inches on center on either side, panel joints shall be offset to fall on different framing members, or framing shall be 3 inches nominal or thicker at adjoining panel edges.

g. In Seismic Design Category D, E or F, where shear design values exceed 350 pounds per linear foot, all framing members receiving edge fastening from abutting panels shall be not less than a single 3-inch nominal member, or two 2-inch nominal members fastened together in accordance with Section 2306.1 to transfer the design shear value between framing members. Wood structural panel joint and sill plate nailing shall be staggered at all panel edges. See AWC SDPWS for sill plate size and anchorage requirements.

h. Staples shall have a minimum crown width of 7/16 inch and shall be installed with their crowns parallel to the long dimension of the framing members.

i. For shear loads of normal or permanent load duration as defined by the ANSI/AWC NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.

TABLE 2306.3(2)—ALLOWABLE SHEAR VALUES (plf) FOR WIND OR SEISMIC LOADING ON SHEAR WALLS OF FIBERBOARD SHEATHING BOARD CONSTRUCTION UTILIZING STAPLES FOR TYPE V CONSTRUCTION ONLY[a, b, c, d, e]

THICKNESS AND GRADE (inches)	STAPLE GAGE AND DIMENSIONS	ALLOWABLE SHEAR VALUE (pounds per linear foot) STAPLE SPACING AT PANEL EDGES (inches)[a]		
		4	3	2
1/2 or 25/32 Structural	No. 16 gage galvanized staple, 7/16" crown 1 3/4 inches long	150	200	225
	No. 16 gage galvanized staple, 1" crown 1 3/4 inches long	220	290	325

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. Fiberboard sheathing shall not be used to brace concrete or masonry walls.

b. Panel edges shall be backed with 2-inch or wider framing of Douglas Fir-larch or Southern pine. For framing of other species: (1) Find specific gravity for species of framing lumber in ANSI/AWC NDS. (2) For staples, multiply the shear value from the table by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.

c. Values shown are for fiberboard sheathing on one side only with long panel dimension either parallel or perpendicular to studs.

d. Fastener shall be spaced 6 inches on center along intermediate framing members.

e. Values are not permitted in *Seismic Design Category* D, E or F.

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TABLE 2306.3(3)—ALLOWABLE SHEAR VALUES FOR WIND OR SEISMIC FORCES FOR SHEAR WALLS OF LATH AND PLASTER OR GYPSUM BOARD WOOD FRAMED WALL ASSEMBLIES UTILIZING STAPLES

TYPE OF MATERIAL	THICKNESS OF MATERIAL	WALL CONSTRUCTION	STAPLE SPACING[b] MAXIMUM (inches)	SHEAR VALUE[a, c] (plf)	MINIMUM STAPLE SIZE [f, g]
1. Expanded metal or woven wire lath and Portland cement plaster	$^{7}/_{8}$"	Unblocked	6	180	No. 16 gage galv. staple, $^{7}/_{8}$" legs
2. Gypsum lath, plain or perforated	$^{3}/_{8}$" lath and $^{1}/_{2}$" plaster	Unblocked	5	100	No. 16 gage galv. staple, $1^{1}/_{8}$" long
3. Gypsum sheathing	$^{1}/_{2}$" × 2′ × 8′	Unblocked	4	75	No. 16 gage galv. staple, $1^{3}/_{4}$" long
	$^{1}/_{2}$" ×4′	Blocked[d] Unblocked	4 7	175 100	
4. Gypsum board, gypsum veneer base or water-resistant gypsum backing board	$^{1}/_{2}$"	Unblocked[d]	7	75	No. 16 gage galv. staple, $1^{1}/_{2}$" long
		Unblocked[d]	4	110	
		Unblocked	7	100	
		Unblocked	4	125	
		Blocked[e]	7	125	
		Blocked[e]	4	150	
	$^{5}/_{8}$"	Unblocked[d]	7	115	No. 16 gage galv. staple, $1^{5}/_{8}$" long
			4	145	
		Blocked[e]	7	145	
			4	175	
		Blocked[e] Two-ply	Base ply: 9 Face ply: 7	250	No. 16 gage galv. staple $1^{5}/_{8}$" long No. 15 gage galv. staple, $2^{1}/_{4}$" long

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per foot = 14.5939 N/m.

a. These shear walls shall not be used to resist loads imposed by masonry or concrete walls (see AWC SDPWS). Values shown are for short-term loading due to wind or seismic loading. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7. Values shown shall be reduced 25 percent for normal loading.

b. Applies to fastening at studs, top and bottom plates and blocking.

c. Except as noted, shear values are based on a maximum framing spacing of 16 inches on center.

d. Maximum framing spacing of 24 inches on center.

e. All edges are blocked, and edge fastening is provided at all supports and all panel edges.

f. Staples shall have a minimum crown width of $^{7}/_{16}$ inch, measured outside the legs, and shall be installed with their crowns parallel to the long dimension of the framing members.

g. Staples for the attachment of gypsum lath and woven-wire lath shall have a minimum crown width of $^{3}/_{4}$ inch, measured outside the legs.

SECTION 2307—LOAD AND RESISTANCE FACTOR DESIGN

2307.1 Load and resistance factor design. The design and construction of wood elements and structures using load and resistance factor design shall be in accordance with ANSI/AWC NDS and AWC SDPWS.

SECTION 2308—CONVENTIONAL LIGHT-FRAME CONSTRUCTION

2308.1 General. The requirements of this section are intended for buildings of conventional light-frame construction not exceeding the story height limitations of Section 2308.2.1. Other construction methods are permitted to be used, provided that a satisfactory design is submitted showing compliance with other provisions of this code. Interior nonload-bearing partitions, ceilings and curtain walls of conventional light-frame construction are not subject to the limitations of Section 2308.2. Detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the *California Residential Code*.

2308.2 Limitations. Buildings are permitted to be constructed in accordance with the provisions of conventional light-frame construction, subject to the limitations in Sections 2308.2.1 through 2308.2.7. ***[DSA-SS, DSA-SS/CC, OSHPD 1R, 2 & 5]*** *2308.2.8.*

2308.2.1 Stories. Structures of conventional light-frame construction shall be limited in story height in accordance with Table 2308.2.1.

TABLE 2308.2.1—ALLOWABLE STORY HEIGHT	
SEISMIC DESIGN CATEGORY	**ALLOWABLE STORY ABOVE GRADE PLANE**
A and B	Three stories
C	Two stories
D and E[a]	One story

For SI:1 inch = 25.4 mm.

a. For the purposes of this section, for buildings assigned to *Seismic Design Category* D or E, cripple walls shall be considered to be a *story* unless cripple walls are solid blocked and do not exceed 14 inches in height.

2308.2.2 Allowable floor-to-floor height. Maximum floor-to-floor height shall not exceed 11 feet, 7 inches (3531 mm). Exterior bearing wall and interior braced wall heights shall not exceed a stud height of 10 feet (3048 mm).

2308.2.3 Allowable loads. Loads shall be in accordance with Chapter 16 and shall not exceed the following:

1. Average dead loads shall not exceed 15 psf (718 N/m^2) for combined roof and ceiling, exterior walls, floors and partitions.

   Exceptions:

   1. Subject to the limitations of Section 2308.10.10, stone or masonry veneer up to the less of 5 inches (127 mm) thick or 50 pounds per square foot (2395 N/m^2) and installed in accordance with Chapter 14 is permitted to a height of 30 feet (9144 mm) above a noncombustible foundation, with an additional 8 feet (2439) permitted for gable ends.
   2. Concrete or masonry fireplaces, heaters and chimneys shall be permitted in accordance with the provisions of this code.
2. Live loads shall not exceed 40 psf (1916 N/m^2) for floors.

   Exception: Live loads for concrete slab-on-ground floors in Risk Categories I and II shall be not more than 125 psf (5985 N/m^2).
3. Allowable stress design ground snow load, $p_{g(asd)}$, shall not exceed 50 psf (2395 N/m^2).
4. Where design for tornado loads is required, tornado loads on the main windforce-resisting system and all components and cladding shall not exceed the corresponding wind loads on these same elements.

2308.2.4 Basic wind speed. *V* shall not exceed 130 miles per hour (57 m/s) (3-second gust).

Exceptions:

1. *V* shall not exceed 140 mph (63 m/s) (3-second gust) for buildings in Exposure Category B that are not located in a hurricane-prone region.
2. Where *V* exceeds 130 mph (3-second gust), the provisions of either AWC WFCM or ICC 600 are permitted to be used.

2308.2.5 Allowable roof span. Ceiling joist and rafter framing constructed in accordance with Section 2308.11 and trusses shall not span more than 40 feet (12 192 mm) between points of vertical support. A ridge board in accordance with Section 2308.11 or 2308.11.3.1 shall not be considered a vertical support.

2308.2.6 Risk category limitation. The use of the provisions for conventional light-frame construction in this section shall not be permitted for Risk Category IV buildings assigned to a Seismic Design Category other than A.

2308.2.7 Hillside light-frame construction. Design in accordance with Section 2308.3 shall be provided for the floor immediately above the cripple walls or post and beam systems and all structural elements and connections from this floor down to and including connections to the foundation and design of the foundation to transfer lateral loads from the framing above in buildings where all of the following apply:

1. The grade slope exceeds 1 unit vertical in 5 units horizontal where averaged across the full length of any side of the building.
2. The tallest cripple wall clear height exceeds 7 feet (2134 mm); or, where a post and beam system occurs at the building perimeter, the post and beam system tallest post clear height exceeds 7 feet (2134 m).
3. Of the total plan area below the lowest framed floor, whether open or enclosed, less than 50 percent is occupiable space having interior wall finishes conforming to Section 2304.7 or Chapter 25.

Exception: Light-frame buildings in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the building are exempt from this provision.

2308.2.8 Additional requirements [DSA-SS & DSA-SS/CC and OSHPD 1R, 2 & 5] *The use of conventional light-frame construction provisions in this section is permitted, subject to the following conditions:*

1. *The design and construction shall also comply with Section 2304 and Section 2305.*
2. *In conjunction with the use of provisions in Section 2308.10 (Wall bracing), engineering analysis shall be furnished that demonstrates compliance of lateral-force-resisting systems with Section 2305.*
3. *In addition to the use of provisions in Section 2308.8 (Floor framing), engineering analysis shall be furnished that demonstrates compliance of floor framing elements and connections with Section 2302.1, Item 1 or 2.*

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4. *In addition to the use of provisions in Section 2308.9 (Wall construction), engineering analysis shall be furnished that demonstrates compliance of wall framing elements and connections with Section 2302.1, Item 1 or 2.*
5. *In addition to the use of provisions in Section 2308.11 (Roof and Ceiling Framing), engineering analysis shall be furnished demonstrating compliance of roof and ceiling framing elements and connections with Section 2302.1, Item 1 or 2.*

2308.3 Portions or elements exceeding limitations of conventional light-frame construction. Where a building of otherwise conventional light-frame construction contains portions or structural elements that exceed the limits of Section 2308.2, those portions or elements, and the supporting load path, shall be designed in accordance with accepted engineering practice and the provisions of this code. For the purposes of this section, the term "portions" shall mean parts of buildings containing volume and area such as a room or a series of rooms. The extent of such design need only demonstrate compliance of the nonconventional light-framed elements with other applicable provisions of this code and shall be compatible with the performance of the conventional light-framed system.

2308.4 Structural elements or systems not described herein. Where a building of otherwise conventional construction contains structural elements or systems not described in Section 2308, these elements or systems shall be designed in accordance with accepted engineering practice and the provisions of this code. The extent of such design need only demonstrate compliance of the nonconventional elements with other applicable provisions of this code and shall be compatible with the performance of the conventionally framed system.

2308.5 Connectors and fasteners. Connectors and fasteners used in conventional construction shall comply with the requirements of Section 2304.10.

2308.6 Cutting, notching and boring of dimensional wood framing. The provisions of this section shall only apply to dimensional wood framing and shall not include engineered wood products, heavy timber or prefabricated/manufactured wood assemblies.

2308.6.1 Floor joists, roof rafters and ceiling joists. Notches on framing ends shall not exceed one-fourth the member depth. Notches in the top or bottom of the member shall not exceed one-sixth the depth and shall not be located in the middle third of the span. A notch not more than one-third of the depth is permitted in the top of a rafter or ceiling joist not further from the face of the support than the depth of the member. Holes bored in members shall not be within 2 inches (51 mm) of the top or bottom of the member and the diameter of any such hole shall not exceed one-third the depth of the member. Where the member is notched, the hole shall not be closer than 2 inches (51 mm) to the notch.

2308.6.1.1 Ceiling joists. Where ceiling joists also serve as floor joists, they shall be considered floor joists within this section.

2308.6.2 Wall studs. In exterior walls and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support loads other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.

2308.6.3 Bored holes. The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall not be closer than $^5/_8$ inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.

2308.6.4 Limitations. In designated lateral force-resisting system assemblies designed in accordance with this code and greater than three stories in height or in Seismic Design Categories C, D, E and F, the cutting, notching and boring of wall studs shall be as prescribed by the registered design professional.

In structures designed in accordance with the *California Residential Code*, modification of wall studs shall comply with the *California Residential Code*.

2308.7 Foundations and footings. Foundations and footings shall be designed and constructed in accordance with Chapter 18. Connections to foundations and footings shall comply with this section.

2308.7.1 Foundation plates or sills. Foundation plates or sills resting on concrete or masonry foundations shall comply with Section 2304.3.1. Foundation plates or sills shall be bolted or anchored to the foundation with not less than $^1/_2$-inch-diameter (12.7 mm) steel bolts or approved anchors spaced to provide equivalent anchorage as the steel bolts. Bolts shall be embedded not less than 7 inches (178 mm) into concrete or masonry. The bolts shall be located in the middle third of the width of the plate. Bolts shall be spaced not more than 6 feet (1829 mm) on center and there shall be not less than two bolts or anchor straps per piece with one bolt or anchor strap located not more than 12 inches (305 mm) or less than 4 inches (102 mm) from each end of each piece. Bolts in sill plates of braced wall lines in structures over two stories above grade shall be spaced not more than 4 feet (1219 mm) on center. A properly sized nut and washer shall be tightened on each bolt to the plate.

2308.7.1.1 Braced wall line sill plate anchorage in Seismic Design Category D. Sill plates along braced wall lines in buildings assigned to Seismic Design Category D shall be anchored with not less than $^1/_2$-inch (12.7 mm) diameter anchor bolts with steel plate washers between the foundation sill plate and the nut, or approved anchor straps load-rated in accordance with Section 2304.10.4 and spaced to provide equivalent anchorage. Plate washers shall be not less than 0.229 inch by 3 inches by 3 inches (5.82 mm by 76 mm by 76 mm) in size. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $^3/_{16}$ inch (4.76 mm) larger than the bolt diameter and a slot length not to exceed $1^3/_4$ inches (44 mm), provided that a standard cut washer is placed between the plate washer and the nut.

2308.7.1.2 Braced wall line sill plate anchorage in Seismic Design Category E. Sill plates along braced wall lines in buildings assigned to Seismic Design Category E shall be anchored with not less than $^5/_8$-inch diameter (15.9 mm) anchor bolts with steel

plate washers between the foundation sill plate and the nut, or approved anchor straps load-rated in accordance with Section 2304.10.4 and spaced to provide equivalent anchorage. Plate washers shall be not less than 0.229 inch by 3 inches by 3 inches (5.82 mm by 76 mm by 76 mm) in size. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $^3/_{16}$ inch (4.76 mm) larger than the bolt diameter and a slot length not to exceed $1^3/_4$ inches (44 mm), provided that a standard cut washer is placed between the plate washer and the nut.

2308.8 Floor framing. Floor framing shall comply with this section.

2308.8.1 Girders. Girders for single-story construction or girders supporting loads from a single floor shall be not less than 4 inches by 6 inches (102 mm by 152 mm) for spans 6 feet (1829 mm) or less, provided that girders are spaced not more than 8 feet (2438 mm) on center. Other girders shall be designed to support the loads specified in this code. Girder end joints shall occur over supports.

Where a girder is spliced over a support, an adequate tie shall be provided. The ends of beams or girders supported on masonry or concrete shall not have less than 3 inches (76 mm) of bearing.

2308.8.1.1 Allowable girder spans. The allowable spans of girders that are fabricated of dimension lumber shall not exceed the values set forth in Table 2308.8.1.1(1) or 2308.8.1.1(2).

TABLE 2308.8.1.1(1)—HEADER AND GIRDER SPANS[a, b] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	ALLOWABLE STRESS DESIGN GROUND SNOW LOAD, $p_{g(asd)}$ (psf)[e]																	
		30						50						70					
		Building width[c] (feet)																	
		12		24		36		12		24		36		12		24		36	
		Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]
Roof and ceiling	1-2 × 6	4-0	1	3-1	2	2-7	2	3-5	1	2-8	2	2-3	2	3-0	2	2-4	2	2-0	2
	1-2 × 8	5-1	2	3-11	2	3-3	2	4-4	2	3-4	2	2-10	2	3-10	2	3-0	2	2-6	3
	1-2 × 10	6-0	2	4-8	2	3-11	2	5-2	2	4-0	2	3-4	3	4-7	2	3-6	3	3-0	3
	1-2 × 12	7-1	2	5-5	2	4-7	3	6-1	2	4-8	3	3-11	3	5-5	2	4-2	3	3-6	3
	2-2 × 4	4-0	1	3-1	1	2-7	1	3-5	1	2-7	1	2-2	1	3-0	1	2-4	1	2-0	1
	2-2 × 6	6-0	1	4-7	1	3-10	1	5-1	1	3-11	1	3-3	2	4-6	1	3-6	2	2-11	2
	2-2 × 8	7-7	1	5-9	1	4-10	2	6-5	1	5-0	2	4-2	2	5-9	1	4-5	2	3-9	2
	2-2 × 10	9-0	1	6-10	2	5-9	2	7-8	2	5-11	2	4-11	2	6-9	2	5-3	2	4-5	2
	2-2 × 12	10-7	2	8-1	2	6-10	2	9-0	2	6-11	2	5-10	2	8-0	2	6-2	2	5-2	3
	3-2 × 8	9-5	1	7-3	1	6-1	1	8-1	1	6-3	1	5-3	2	7-2	1	5-6	2	4-8	2
	3-2 × 10	11-3	1	8-7	1	7-3	2	9-7	1	7-4	2	6-2	2	8-6	1	6-7	2	5-6	2
	3-2 × 12	13-2	1	10-1	2	8-6	2	11-3	2	8-8	2	7-4	2	10-0	2	7-9	2	6-6	2
	4-2 × 8	10-11	1	8-4	1	7-0	1	9-4	1	7-2	1	6-0	1	8-3	1	6-4	1	5-4	2
	4-2 × 10	12-11	1	9-11	1	8-4	1	11-1	1	8-6	1	7-2	2	9-10	1	7-7	2	6-4	2
	4-2 × 12	15-3	1	11-8	1	9-10	2	13-0	1	10-0	2	8-5	2	11-7	1	8-11	2	7-6	2
Roof, ceiling and one center-bearing floor	1-2 × 6	3-3	1	2-7	2	2-2	2	3-0	2	2-4	2	2-0	2	2-9	2	2-2	2	1-10	2
	1-2 × 8	4-1	2	3-3	2	2-9	2	3-9	2	3-0	2	2-6	3	3-6	2	2-9	2	2-4	3
	1-2 × 10	4-11	2	3-10	2	3-3	3	4-6	2	3-6	3	3-0	3	4-1	2	3-3	3	2-9	3
	1-2 × 12	5-9	2	4-6	3	3-10	3	5-3	2	4-2	3	3-6	3	4-10	3	3-10	3	3-3	4
	2-2 × 4	3-3	1	2-6	1	2-2	1	3-0	1	2-4	1	2-0	1	2-8	1	2-2	1	1-10	1
	2-2 × 6	4-10	1	3-9	1	3-3	2	4-5	1	3-6	2	3-0	2	4-1	1	3-3	2	2-9	2
	2-2 × 8	6-1	1	4-10	2	4-1	2	5-7	2	4-5	2	3-9	2	5-2	2	4-1	2	3-6	2
	2-2 × 10	7-3	2	5-8	2	4-10	2	6-8	2	5-3	2	4-5	2	6-1	2	4-10	2	4-1	2
	2-2 × 12	8-6	2	6-8	2	5-8	2	7-10	2	6-2	2	5-3	3	7-2	2	5-8	2	4-10	3
	3-2 × 8	7-8	1	6-0	1	5-1	2	7-0	1	5-6	2	4-8	2	6-5	1	5-1	2	4-4	2
	3-2 × 10	9-1	1	7-2	2	6-1	2	8-4	1	6-7	2	5-7	2	7-8	2	6-1	2	5-2	2
	3-2 × 12	10-8	2	8-5	2	7-2	2	9-10	2	7-8	2	6-7	2	9-0	2	7-1	2	6-1	2
	4-2 × 8	8-10	1	6-11	1	5-11	1	8-1	1	6-4	1	5-5	2	7-5	1	5-11	1	5-0	2
	4-2 × 10	10-6	1	8-3	2	7-0	2	9-8	1	7-7	2	6-5	2	8-10	1	7-0	2	6-0	2
	4-2 × 12	12-4	1	9-8	2	8-3	2	11-4	2	8-11	2	7-7	2	10-4	2	8-3	2	7-0	2

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TABLE 2308.8.1.1(1)—HEADER AND GIRDER SPANS[a, b] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir and required number of jack studs)—continued

GIRDERS AND HEADERS SUPPORTING	SIZE	ALLOWABLE STRESS DESIGN GROUND SNOW LOAD, $p_{g(asd)}$, (psf)[e]																	
		30						50						70					
		Building width[c] (feet)																	
		12		24		36		12		24		36		12		24		36	
		Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]
Roof, ceiling and one clear span floor	1-2 × 6	2-11	2	2-3	2	1-11	2	2-9	2	2-1	2	1-9	2	2-7	2	2-0	2	1-8	2
	1-2 × 8	3-9	2	2-10	2	2-5	3	3-6	2	2-8	2	2-3	3	3-3	2	2-6	3	2-2	3
	1-2 × 10	4-5	2	3-5	3	2-10	3	4-2	2	3-2	3	2-8	3	3-11	2	3-0	3	2-6	3
	1-2 × 12	5-2	2	4-0	3	3-4	3	4-10	3	3-9	3	3-2	4	4-7	3	3-6	3	3-0	4
	2-2 × 4	2-11	1	2-3	1	1-10	1	2-9	1	2-1	1	1-9	1	2-7	1	2-0	1	1-8	1
	2-2 × 6	4-4	1	3-4	2	2-10	2	4-1	1	3-2	2	2-8	2	3-10	1	3-0	2	2-6	2
	2-2 × 8	5-6	2	4-3	2	3-7	2	5-2	2	4-0	2	3-4	2	4-10	2	3-9	2	3-2	2
	2-2 × 10	6-7	2	5-0	2	4-2	2	6-1	2	4-9	2	4-0	2	5-9	2	4-5	2	3-9	3
	2-2 × 12	7-9	2	5-11	2	4-11	3	7-2	2	5-7	2	4-8	3	6-9	2	5-3	3	4-5	3
	3-2 × 8	6-11	1	5-3	2	4-5	2	6-5	1	5-0	2	4-2	2	6-1	1	4-8	2	4-0	2
	3-2 × 10	8-3	2	6-3	2	5-3	2	7-8	2	5-11	2	5-0	2	7-3	2	5-7	2	4-8	2
	3-2 × 12	9-8	2	7-5	2	6-2	2	9-0	2	7-0	2	5-10	2	8-6	2	6-7	2	5-6	3
	4-2 × 8	8-0	1	6-1	1	5-1	2	7-5	1	5-9	2	4-10	2	7-0	1	5-5	2	4-7	2
	4-2 × 10	9-6	1	7-3	2	6-1	2	8-10	1	6-10	2	5-9	2	8-4	1	6-5	2	5-5	2
	4-2 × 12	11-2	2	8-6	2	7-2	2	10-5	2	8-0	2	6-9	2	9-10	2	7-7	2	6-5	2
Roof, ceiling and two center-bearing floors	1-2 × 6	2-8	2	2-1	2	1-10	2	2-7	2	2-0	2	1-9	2	2-5	2	1-11	2	1-8	2
	1-2 × 8	3-5	2	2-8	2	2-4	3	3-3	2	2-7	2	2-2	3	3-1	2	2-5	3	2-1	3
	1-2 × 10	4-0	2	3-2	3	2-9	3	3-10	2	3-1	3	2-7	3	3-8	2	2-11	3	2-5	3
	1-2 × 12	4-9	3	3-9	3	3-2	4	4-6	3	3-7	3	3-1	4	4-3	3	3-5	3	2-11	4
	2-2 × 4	2-8	1	2-1	1	1-9	1	2-6	1	2-0	1	1-8	1	2-5	1	1-11	1	1-7	1
	2-2 × 6	4-0	1	3-2	2	2-8	2	3-9	1	3-0	2	2-7	2	3-7	1	2-10	2	2-5	2
	2-2 × 8	5-0	2	4-0	2	3-5	2	4-10	2	3-10	2	3-3	2	4-7	2	3-7	2	3-1	2
	2-2 × 10	6-0	2	4-9	2	4-0	2	5-8	2	4-6	2	3-10	3	5-5	2	4-3	2	3-8	3
	2-2 × 12	7-0	2	5-7	2	4-9	3	6-8	2	5-4	3	4-6	3	6-4	2	5-0	3	4-3	3
	3-2 × 8	6-4	1	5-0	2	4-3	2	6-0	1	4-9	2	4-1	2	5-8	2	4-6	2	3-10	2
	3-2 × 10	7-6	2	5-11	2	5-1	2	7-1	2	5-8	2	4-10	2	6-9	2	5-4	2	4-7	2
	3-2 × 12	8-10	2	7-0	2	5-11	2	8-5	2	6-8	2	5-8	3	8-0	2	6-4	2	5-4	3
	4-2 × 8	7-3	1	5-9	1	4-11	2	6-11	1	5-6	2	4-8	2	6-7	1	5-2	2	4-5	2
	4-2 × 10	8-8	1	6-10	2	5-10	2	8-3	2	6-6	2	5-7	2	7-10	2	6-2	2	5-3	2
	4-2 × 12	10-2	2	8-1	2	6-10	2	9-8	2	7-8	2	6-7	2	9-2	2	7-3	2	6-2	2
Roof, ceiling and two clear span floors	1-2 × 6	2-3	2	1-9	2	1-5	2	2-3	2	1-9	2	1-5	3	2-2	2	1-8	2	1-5	3
	1-2 × 8	2-10	2	2-2	3	1-10	3	2-10	2	2-2	3	1-10	3	2-9	2	2-1	3	1-10	3
	1-2 × 10	3-4	2	2-7	3	2-2	3	3-4	3	2-7	3	2-2	4	3-3	3	2-6	3	2-2	4
	1-2 × 12	4-0	3	3-0	3	2-7	4	4-0	3	3-0	4	2-7	4	3-10	3	3-0	4	2-6	4
	2-2 × 4	2-3	1	1-8	1	1-4	1	2-3	1	1-8	1	1-4	1	2-2	1	1-8	1	1-4	2
	2-2 × 6	3-4	1	2-6	2	2-2	2	3-4	2	2-6	2	2-2	2	3-3	2	2-6	2	2-1	2
	2-2 × 8	4-3	2	3-3	2	2-8	2	4-3	2	3-3	2	2-8	2	4-1	2	3-2	2	2-8	3
	2-2 × 10	5-0	2	3-10	2	3-2	3	5-0	2	3-10	2	3-2	3	4-10	2	3-9	3	3-2	3
	2-2 × 12	5-11	2	4-6	3	3-9	3	5-11	2	4-6	3	3-9	3	5-8	2	4-5	3	3-9	3
	3-2 × 8	5-3	1	4-0	2	3-5	2	5-3	2	4-0	2	3-5	2	5-1	2	3-11	2	3-4	2
	3-2 × 10	6-3	2	4-9	2	4-0	2	6-3	2	4-9	2	4-0	2	6-1	2	4-8	2	4-0	3
	3-2 × 12	7-5	2	5-8	2	4-9	3	7-5	2	5-8	2	4-9	3	7-2	2	5-6	3	4-8	3
	4-2 × 8	6-1	1	4-8	2	3-11	2	6-1	1	4-8	2	3-11	2	5-11	1	4-7	2	3-10	2
	4-2 × 10	7-3	2	5-6	2	4-8	2	7-3	2	5-6	2	4-8	2	7-0	2	5-5	2	4-7	2
	4-2 × 12	8-6	2	6-6	2	5-6	2	8-6	2	6-6	2	5-6	2	8-3	2	6-4	2	5-4	3

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine and spruce-pine fir.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Use 30 psf allowable stress design ground snow load for cases in which allowable stress design ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

f. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

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TABLE 2308.8.1.1(2)—HEADER AND GIRDER SPANS[a, b] FOR INTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir and required number of jack studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING WIDTH[c] (feet)					
		12		24		36	
		Span[e]	NJ[d]	Span[e]	NJ[d]	Span[e]	NJ[d]
One floor only	2-2 × 4	4-1	1	2-10	1	2-4	1
	2-2 × 6	6-1	1	4-4	1	3-6	1
	2-2 × 8	7-9	1	5-5	1	4-5	2
	2-2 × 10	9-2	1	6-6	2	5-3	2
	2-2 × 12	10-9	1	7-7	2	6-3	2
	3-2 × 8	9-8	1	6-10	1	5-7	1
	3-2 × 10	11-5	1	8-1	1	6-7	2
	3-2 × 12	13-6	1	9-6	2	7-9	2
	4-2 × 8	11-2	1	7-11	1	6-5	1
	4-2 × 10	13-3	1	9-4	1	7-8	1
	4-2 × 12	15-7	1	11-0	1	9-0	2
Two floors	2-2 × 4	2-7	1	1-11	1	1-7	1
	2-2 × 6	3-11	1	2-11	2	2-5	2
	2-2 × 8	5-0	1	3-8	2	3-1	2
	2-2 × 10	5-11	2	4-4	2	3-7	2
	2-2 × 12	6-11	2	5-2	2	4-3	3
	3-2 × 8	6-3	1	4-7	2	3-10	2
	3-2 × 10	7-5	1	5-6	2	4-6	2
	3-2 × 12	8-8	2	6-5	2	5-4	2
	4-2 × 8	7-2	1	5-4	1	4-5	2
	4-2 × 10	8-6	1	6-4	2	5-3	2
	4-2 × 12	10-1	1	7-5	2	6-2	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine and spruce-pine fir.

c. *Building* width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an *approved* framing anchor attached to the full-height wall stud and to the header.

e. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

2308.8.2 Floor joists. Floor joists shall comply with this section.

2308.8.2.1 Span. Spans for floor joists shall be in accordance with Table 2308.8.2.1(1), Table 2308.8.2.1(2) or the AWC STJR.

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TABLE 2308.8.2.1(1)—FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential sleeping areas, live load = 30 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 × 6	2 × 8	2 × 10	2 × 12	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	12-6	16-6	21-0	25-7	12-6	16-6	21-0	25-7
	Douglas Fir-Larch	#1	12-0	15-10	20-3	24-8	12-0	15-7	19-0	22-0
	Douglas Fir-Larch	#2	11-10	15-7	19-10	23-0	11-6	14-7	17-9	20-7
	Douglas Fir-Larch	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Hem-Fir	SS	11-10	15-7	19-10	24-2	11-10	15-7	19-10	24-2
	Hem-Fir	#1	11-7	15-3	19-5	23-7	11-7	15-2	18-6	21-6
	Hem-Fir	#2	11-0	14-6	18-6	22-6	11-0	14-4	17-6	20-4
	Hem-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Southern Pine	SS	12-3	16-2	20-8	25-1	12-3	16-2	20-8	25-1
	Southern Pine	#1	11-10	15-7	19-10	24-2	11-10	15-7	18-7	22-0
	Southern Pine	#2	11-3	14-11	18-1	21-4	10-9	13-8	16-2	19-1
	Southern Pine	#3	9-2	11-6	14-0	16-6	8-2	10-3	12-6	14-9
	Spruce-Pine-Fir	SS	11-7	15-3	19-5	23-7	11-7	15-3	19-5	23-7
	Spruce-Pine-Fir	#1	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#2	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
16	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-0
	Douglas Fir-Larch	#1	10-11	14-5	18-5	21-4	10-8	13-6	16-5	19-1
	Douglas Fir-Larch	#2	10-9	14-1	17-2	19-11	9-11	12-7	15-5	17-10
	Douglas Fir-Larch	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	20-9	10-4	13-1	16-0	18-7
	Hem-Fir	#2	10-0	13-2	16-10	19-8	9-10	12-5	15-2	17-7
	Hem-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-9	14-2	18-0	21-4	10-9	13-9	16-1	19-1
	Southern Pine	#2	10-3	13-3	15-8	18-6	9-4	11-10	14-0	16-6
	Southern Pine	#3	7-11	10-10	12-1	14-4	7-1	8-11	10-10	12-10
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-4
	Spruce-Pine-Fir	#1	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6

TABLE 2308.8.2.1(1)—FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES (Residential sleeping areas, live load = 30 psf, L/Δ = 360)—continued

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 × 6	2 × 8	2 × 10	2 × 12	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	10-8	14-1	18-0	21-10	10-8	14-1	18-0	21-0
	Douglas Fir-Larch	#1	10-4	13-7	16-9	19-6	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	10-1	12-10	15-8	18-3	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Hem-Fir	SS	10-1	13-4	17-0	20-8	10-1	13-4	17-0	20-7
	Hem-Fir	#1	9-10	13-0	16-4	19-0	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-5	12-5	15-6	17-1	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Southern Pine	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Southern Pine	#1	10-1	13-4	16-5	19-6	9-11	12-7	14-8	17-5
	Southern Pine	#2	9-6	12-1	14-4	16-10	8-6	10-10	12-10	15-1
	Southern Pine	#3	7-3	9-1	11-0	13-1	6-5	8-2	9-10	11-8
	Spruce-Pine-Fir	SS	9-10	13-0	16-7	20-2	9-10	13-0	16-7	19-6
	Spruce-Pine-Fir	#1	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
24	Douglas Fir-Larch	SS	9-11	13-1	16-8	20-3	9-11	13-1	16-2	18-9
	Douglas Fir-Larch	#1	9-7	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Hem-Fir	SS	9-4	12-4	15-9	19-2	9-4	12-4	15-9	18-5
	Hem-Fir	#1	9-2	12-0	14-8	17-0	8-6	10-9	13-1	15-2
	Hem-Fir	#2	8-9	11-4	13-10	16-1	8-0	10-2	12-5	14-4
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Southern Pine	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-8
	Southern Pine	#1	9-4	12-4	14-8	17-5	8-10	11-3	13-1	15-7
	Southern Pine	#2	8-6	10-10	12-10	15-1	7-7	9-8	11-5	13-6
	Southern Pine	#3	6-5	8-2	9-10	11-8	5-9	7-3	8-10	10-5
	Spruce-Pine-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-0	17-5
	Spruce-Pine-Fir	#1	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#2	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
Note: Check sources for availability of lumber in lengths greater than 20 feet.

TABLE 2308.8.2.1(2)—FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 × 6	2 × 8	2 × 10	2 × 12	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas Fir-Larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas Fir-Larch	#2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas Fir-Larch	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-Fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-9	14-2	18-0	21-11	10-9	14-2	16-11	20-1
	Southern Pine	#2	10-3	13-6	16-2	19-1	9-10	12-6	14-9	17-5
	Southern Pine	#3	8-2	10-3	12-6	14-9	7-5	9-5	11-5	13-6
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-Pine-Fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas Fir-Larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas Fir-Larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-Fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-Fir	#1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern Pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern Pine	#1	9-9	12-10	16-1	19-1	9-9	12-7	14-8	17-5
	Southern Pine	#2	9-4	11-10	14-0	16-6	8-6	10-10	12-10	15-1
	Southern Pine	#3	7-1	8-11	10-10	12-10	6-5	8-2	9-10	11-8
	Spruce-Pine-Fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-Pine-Fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4

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TABLE 2308.8.2.1(2)—FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES (Residential living areas, live load = 40 psf, L/Δ = 360)—continued

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 × 6	2 × 8	2 × 10	2 × 12	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas Fir-Larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-Fir	#1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-Fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern Pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern Pine	#1	9-2	12-1	14-8	17-5	9-0	11-5	13-5	15-11
	Southern Pine	#2	8-6	10-10	12-10	15-1	7-9	9-10	11-8	13-9
	Southern Pine	#3	6-5	8-2	9-10	11-8	5-11	7-5	9-0	10-8
	Spruce-Pine-Fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-Pine-Fir	#	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas Fir-Larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas Fir-Larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas Fir-Larch	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas Fir-Larch	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-Fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10[a]
	Hem-Fir	#1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-Fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern Pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-0
	Southern Pine	#1	8-6	11-3	13-1	15-7	8-1	10-3	12-0	14-3
	Southern Pine	#2	7-7	9-8	11-5	13-6	7-0	8-10	10-5	12-4
	Southern Pine	#3	5-9	7-3	8-10	10-5	5-3	6-8	8-1	9-6
	Spruce-Pine-Fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-Pine-Fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
Note: Check sources for availability of lumber in lengths greater than 20 feet.
a. End bearing length shall be increased to 2 inches.

2308.8.2.2 Bearing. The ends of each joist shall have not less than $1^1/_2$ inches (38 mm) of bearing on wood or metal, or not less than 3 inches (76 mm) on masonry, except where supported on a 1-inch by 4-inch (25 mm by 102 mm) ribbon strip and nailed to the adjoining stud.

2308.8.2.3 Framing details. Joists shall be supported laterally at the ends and at each support by solid blocking except where the ends of the joists are nailed to a header, band or rim joist or to an adjoining stud or by other means. Solid blocking shall be not less than 2 inches (51 mm) in thickness and the full depth of the joist. Joist framing from opposite sides of a beam, girder or partition shall be lapped not less than 3 inches (76 mm) or the opposing joists shall be tied together in an *approved* manner. Joists framing into the side of a wood girder shall be supported by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

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2308.8.3 Engineered wood products. Engineered wood products shall be installed in accordance with manufacturer's recommendations. Cuts, notches and holes bored in trusses, structural composite lumber, structural glued-laminated members or I-joists are not permitted except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

2308.8.4 Framing around openings. Trimmer and header joists shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header joists more than 6 feet (1829 mm) in length shall be supported by framing anchors or joist hangers unless bearing on a beam, partition or wall. Tail joists over 12 feet (3658 mm) in length shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

2308.8.4.1 Openings in floor diaphragms in Seismic Design Categories B, C, D and E. Openings in horizontal diaphragms in Seismic Design Categories B, C, D and E with a dimension that is greater than 4 feet (1219 mm) shall be constructed with metal ties and blocking in accordance with this section and Figure 2308.8.4.1(1). Metal ties shall be not less than 0.058 inch [1.47 mm (16 galvanized gage)] in thickness by $1^1/_2$ inches (38 mm) in width and shall have a yield stress not less than 33,000 psi (227 MPa). Blocking shall extend not less than the dimension of the opening in the direction of the tie and blocking. Ties shall be attached to blocking in accordance with the manufacturer's instructions but with not less than eight 16d common nails on each side of the header-joist intersection.

Openings in floor diaphragms in Seismic Design Categories D and E shall not have any dimension exceeding 50 percent of the distance between braced wall lines or an area greater than 25 percent of the area between orthogonal pairs of braced wall lines [see Figure 2308.8.4.1(2)]; or the portion of the structure containing the opening shall be designed in accordance with accepted engineering practice to resist the forces specified in Chapter 16, to the extent such irregular opening affects the performance of the conventional framing system.

FIGURE 2308.8.4.1(1)—OPENINGS IN FLOOR AND ROOF DIAPHRAGMS

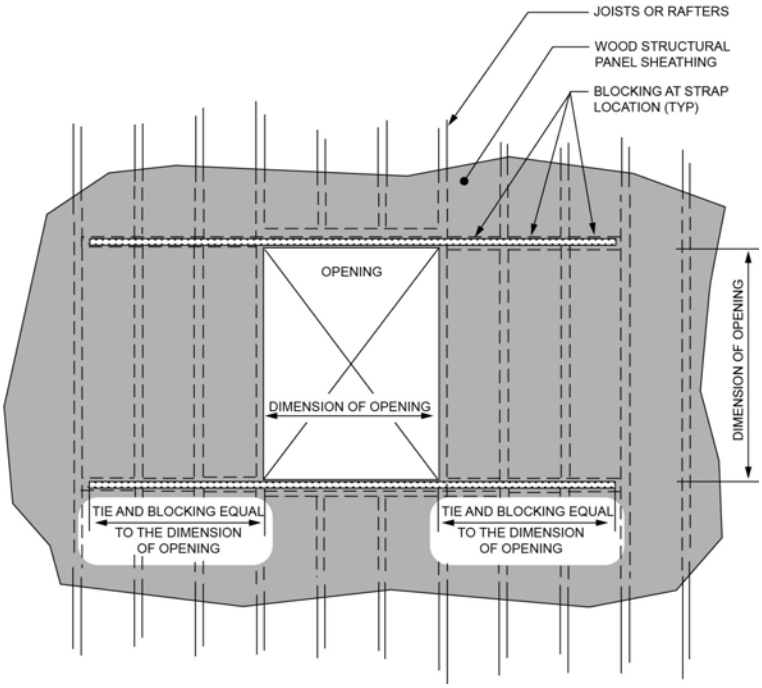
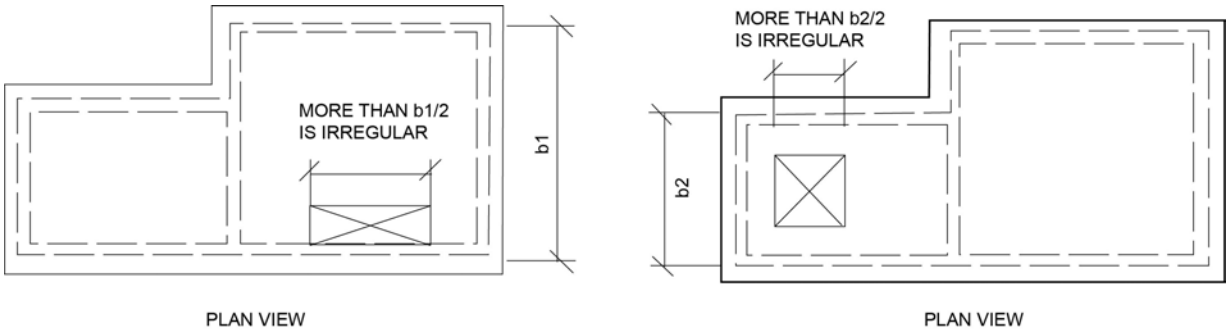

JOISTS OR RAFTERS
WOOD STRUCTURAL PANEL SHEATHING
BLOCKING AT STRAP LOCATION (TYP)
OPENING
DIMENSION OF OPENING
DIMENSION OF OPENING
TIE AND BLOCKING EQUAL TO THE DIMENSION OF OPENING
TIE AND BLOCKING EQUAL TO THE DIMENSION OF OPENING

FIGURE 2308.8.4.1(2)—OPENING LIMITATIONS FOR FLOOR AND ROOF DIAPHRAGMS



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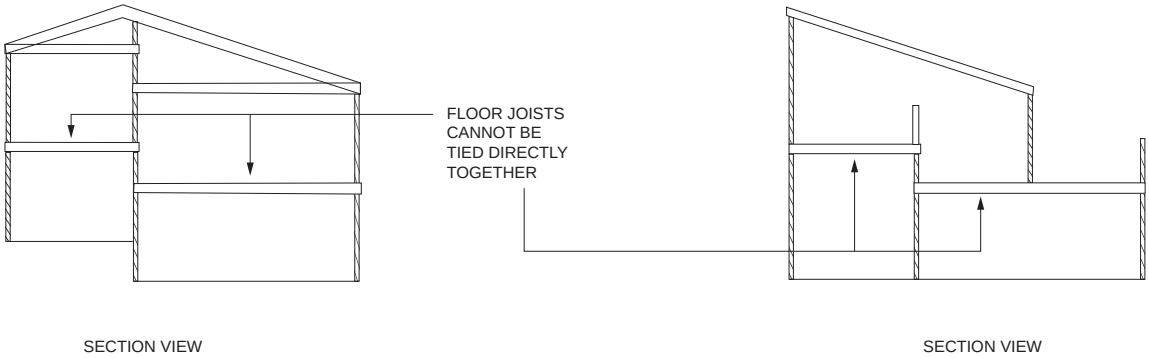
2308.8.4.2 Vertical offsets in floor diaphragms in Seismic Design Categories D and E. In Seismic Design Categories D and E, portions of a floor level shall not be vertically offset such that the framing members on either side of the offset cannot be lapped or tied together in an approved manner in accordance with Figure 2308.8.4.2 unless the portion of the *structure* containing the irregular offset is designed in accordance with accepted engineering practice.

Exception: Framing supported directly by foundations need not be lapped or tied directly together.

FIGURE 2308.8.4.2—PORTIONS OF FLOOR LEVEL OFFSET VERTICALLY



2308.8.5 Joists supporting bearing partitions. Bearing partitions parallel to joists shall be supported on beams, girders, doubled joists, walls or other bearing partitions. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size to carry the additional load.

2308.8.6 Lateral support. Floor and ceiling framing with a nominal depth-to-thickness ratio not less than 5 to 1 shall have one edge held in line for the entire span. Where the nominal depth-to-thickness ratio of the framing member exceeds 6 to 1, there shall be one line of bridging for each 8 feet (2438 mm) of span, unless both edges of the member are held in line. The bridging shall consist of not less than 1-inch by 3-inch (25 mm by 76 mm) lumber, double nailed at each end, or equivalent metal bracing of equal rigidity, full-depth solid blocking or other approved means. A line of bridging shall be required at supports where equivalent lateral support is not otherwise provided.

2308.8.7 Structural floor sheathing. Structural floor sheathing shall comply with the provisions of Section 2304.8.1.

2308.8.8 Under-floor ventilation. For under-floor ventilation, see Section 1202.4.

2308.8.9 Floor framing supporting braced wall panels. Where braced wall panels are supported by cantilevered floors or are set back from the floor joist support, the floor framing shall comply with Section 2308.10.7.

2308.8.10 Anchorage of exterior means of egress components in Seismic Design Categories D and E. Exterior egress balconies, exterior stairways and ramps and similar means of egress components in structures assigned to Seismic Design Category D or E shall be positively anchored to the primary structure at not more than 8 feet (2438 mm) on center or shall be designed for lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

2308.9 Wall construction. Walls of conventional light-frame construction shall be in accordance with this section.

2308.9.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table 2308.9.1.

Studs shall be continuous from a support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Table 2308.8.1.1(1) or 2308.8.1.1(2).

TABLE 2308.9.1—SIZE, HEIGHT AND SPACING OF WOOD STUDS[c]

STUD SIZE (inches)	BEARING WALLS				NONBEARING WALLS	
	Laterally unsupported stud height[a] (feet)	Supporting roof and ceiling only	Supporting one floor, roof and ceiling	Supporting two floors, roof and ceiling	Laterally unsupported stud height[a] (feet)	Spacing (inches)
		Spacing (inches)				
2 × 3[b]	—	—	—	—	10	16
2 × 4	10	24	16	—	14	24
3 × 4	10	24	24	16	14	24
2 × 5	10	24	24	—	16	24
2 × 6	10	24	24	16	20	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by an analysis.

b. Shall not be used in exterior walls.

c. Utility-grade studs shall not be spaced more than 16 inches on center or support more than a roof and ceiling, or exceed 8 feet in height for exterior walls and load-bearing walls or 10 feet for interior nonload-bearing walls.

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2308.9.2 Framing details. Studs shall be placed with their wide dimension perpendicular to the wall. Not less than three studs shall be installed at each corner of an exterior wall.

Exceptions:

1. In interior nonbearing walls and partitions, studs are permitted to be set with the long dimension parallel to the wall.
2. At corners, two studs are permitted, provided that wood spacers or backup cleats of $^3/_8$-inch-thick (9.5 mm) wood structural panel, $^3/_8$-inch (9.5 mm) Type M "Exterior Glue" particleboard, 1-inch-thick (25 mm) lumber or other approved devices that will serve as an adequate backing for the attachment of facing materials are used. Where fire-resistance ratings or shear values are involved, wood spacers, backup cleats or other devices shall not be used unless specifically approved for such use.

2308.9.3 Plates and sills. Studs shall have plates and sills in accordance with this section.

2308.9.3.1 Bottom plate or sill. Studs shall have full bearing on a plate or sill. Plates or sills shall be not less than 2 inches (51 mm) nominal in thickness and have a width not less than the width of the wall studs.

2308.9.3.2 Top plates. Bearing and exterior wall studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with other partitions. End joints in double top plates shall be offset not less than 48 inches (1219 mm), and shall be nailed in accordance with Table 2304.10.2. Plates shall be a nominal 2 inches (51 mm) in depth and have a width not less than the width of the studs.

Exception: A single top plate is permitted, provided that the plate is adequately tied at corners and intersecting walls by not less than the equivalent of 3-inch by 6-inch (76 mm by 152 mm) by 0.036-inch-thick (0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by six 8d [$2^1/_2$-inch by 0.113-inch (64-mm by 2.87 mm)] box nails or equivalent on each side of the joint. For the butt-joint splice between adjacent single top plates, not less than the equivalent of a 3-inch by 12-inch (76 mm by 304 mm) by 0.036-inch-thick (0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by 12 8d [$2^1/_2$-inch by 0.113-inch (64 mm by 2.87 mm)] box nails on each side of the joint shall be required, provided that the rafters, joists or trusses are centered over the studs with a tolerance of not more than 1 inch (25 mm). The top plate shall not be required over headers that are in the same plane and in line with the upper surface of the adjacent top plates and are tied to adjacent wall sections as required for the butt joint splice between adjacent single top plates.

Where bearing studs are spaced at 24-inch (610 mm) intervals, top plates are less than two 2-inch by 6-inch (51 mm by 152 mm) or two 3-inch by 4-inch (76 mm by 102 mm) members and the floor joists, floor trusses or roof trusses that they support are spaced at more than 16-inch (406 mm) intervals, such joists or trusses shall bear within 5 inches (127 mm) of the studs beneath or a third plate shall be installed.

2308.9.4 Nonload-bearing walls and partitions. In nonload-bearing walls and partitions, that are not part of a braced wall panel, studs shall be spaced not more than 24 inches (610 mm) on center. In interior nonload-bearing walls and partitions, studs are permitted to be set with the long dimension parallel to the wall. Where studs are set with the long dimensions parallel to the wall, use of utility grade lumber or studs exceeding 10 feet (3048 mm) is not permitted. Interior nonload-bearing partitions shall be capped with not less than a single top plate installed to provide overlapping at corners and at intersections with other walls and partitions. The plate shall be continuously tied at joints by solid blocking not less than 16 inches (406 mm) in length and equal in size to the plate or by $^1/_2$-inch by $1^1/_2$-inch (12.7 mm by 38 mm) metal ties with spliced sections fastened with two 16d nails on each side of the joint.

2308.9.5 Openings in walls and partitions. Openings in exterior and interior walls and partitions shall comply with Sections 2308.9.5.1 through 2308.9.5.3.

2308.9.5.1 Openings in exterior bearing walls. Headers shall be provided over each opening in exterior bearing walls. The size and spans in Table 2308.8.1.1(1) are permitted to be used for one- and two-family *dwellings*. Headers for other buildings shall be designed in accordance with Section 2302.1, Item 1 or 2. Headers of two or more pieces of nominal 2-inch (51 mm) framing lumber set on edge shall be permitted in accordance with Table 2308.8.1.1(1) and nailed together in accordance with Table 2304.10.2 or of solid lumber of equivalent size.

Single-member headers of nominal 2-inch (51 mm) thickness shall be framed with a single flat 2-inch-nominal (51 mm) member or wall plate not less in width than the wall studs on the top and bottom of the header in accordance with Figures 2308.9.5.1(1) and 2308.9.5.1(2) and face nailed to the top and bottom of the header with 10d box nails [3 inches × 0.128 inches (76 mm × 3.3 mm)] spaced 12 inches (305 mm) on center.

Wall studs shall support the ends of the header in accordance with Table 2308.8.1.1(1). Each end of a lintel or header shall have a bearing length of not less than $1^1/_2$ inches (38 mm) for the full width of the lintel.

FIGURE 2308.9.5.1(1)—SINGLE-MEMBER HEADER IN EXTERIOR BEARING WALL

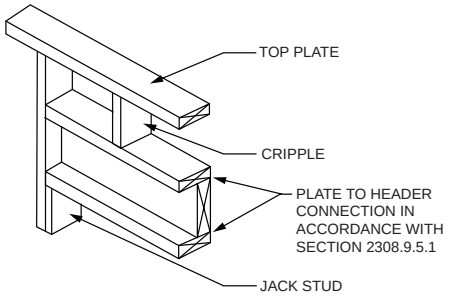

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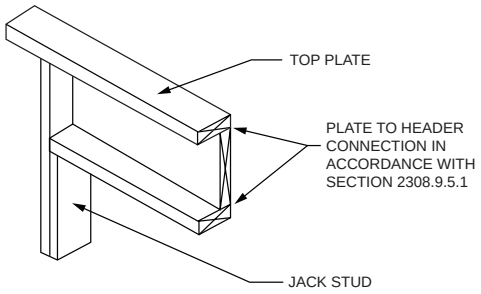
FIGURE 2308.9.5.1(2)—ALTERNATIVE SINGLE-MEMBER HEADER WITHOUT CRIPPLE



2308.9.5.2 Openings in interior bearing partitions. Headers shall be provided over each opening in interior bearing partitions as required in Section 2308.9.5.1. The spans in Table 2308.8.1.1(2) are permitted to be used. Wall studs shall support the ends of the header in accordance with Table 2308.8.1.1(1) or 2308.8.1.1(2), as applicable.

2308.9.5.3 Openings in interior nonbearing partitions. Openings in nonbearing partitions are permitted to be framed with single studs and headers. Each end of a lintel or header shall have a bearing length of not less than $1^1/_2$ inches (38 mm) for the full width of the lintel.

2308.9.6 Cripple walls. Foundation cripple walls shall be framed of studs that are not less than the size of the studs above. Exterior cripple wall studs shall be not less than 14 inches (356 mm) in length, or shall be framed of solid blocking. Where exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story. See Section 2308.10.6 for cripple wall bracing.

2308.9.7 Bridging. Unless covered by interior or exterior wall coverings or sheathing meeting the minimum requirements of this code, stud partitions or walls with studs having a height-to-least-thickness ratio exceeding 50 shall have bridging that is not less than 2 inches (51 mm) in thickness and of the same width as the studs fitted snugly and nailed thereto to provide adequate lateral support. Bridging shall be placed in every stud cavity and at a frequency such that studs so braced shall not have a height-to-least-thickness ratio exceeding 50 with the height of the stud measured between horizontal framing and bridging or between bridging, whichever is greater.

2308.9.8 Pipes in walls. Stud partitions containing plumbing, heating or other pipes shall be framed and the joists underneath spaced to provide proper clearance for the piping. Where a partition containing piping runs parallel to the floor joists, the joists underneath such partitions shall be doubled and spaced to permit the passage of pipes and shall be bridged. Where plumbing, heating or other pipes are placed in, or partly in, a partition, necessitating the cutting of the soles or plates, a metal tie not less than 0.058 inch (1.47 mm) (16 galvanized gage) and $1^1/_2$ inches (38 mm) in width shall be fastened to each plate across and to each side of the opening with not less than six 16d nails.

2308.9.9 Exterior wall sheathing. Except where stucco construction that complies with Section 2510 is installed, the outside of exterior walls, including gables, of enclosed buildings shall be sheathed with one of the materials of the nominal thickness specified in Table 2308.9.9 with fasteners in accordance with the requirements of Section 2304.10 or fasteners designed in accordance with accepted engineering practice. Alternatively, sheathing materials and fasteners complying with Section 2304.6 shall be permitted.

TABLE 2308.9.9—MINIMUM THICKNESS OF WALL SHEATHING

SHEATHING TYPE	MINIMUM THICKNESS	MAXIMUM WALL STUD SPACING
Diagonal wood boards	$^5/_8$ inch	24 inches on center
Structural fiberboard	$^1/_2$ inch	16 inches on center
Wood structural panel	In accordance with Tables 2308.10.3(2) and 2308.10.3(3)	—
M-S “Exterior Glue” and M-2 “Exterior Glue” particleboard	In accordance with Section 2306.3 and Table 2308.10.3(4)	—
Gypsum sheathing	$^1/_2$ inch	16 inches on center
Reinforced cement mortar	1 inch	24 inches on center
Hardboard panel siding	In accordance with Table 2308.10.3(5)	—

For SI: 1 inch = 25.4 mm.

2308.10 Wall bracing. Buildings shall be provided with exterior and interior braced wall lines as described in Sections 2308.10.1 through 2308.10.10.2.

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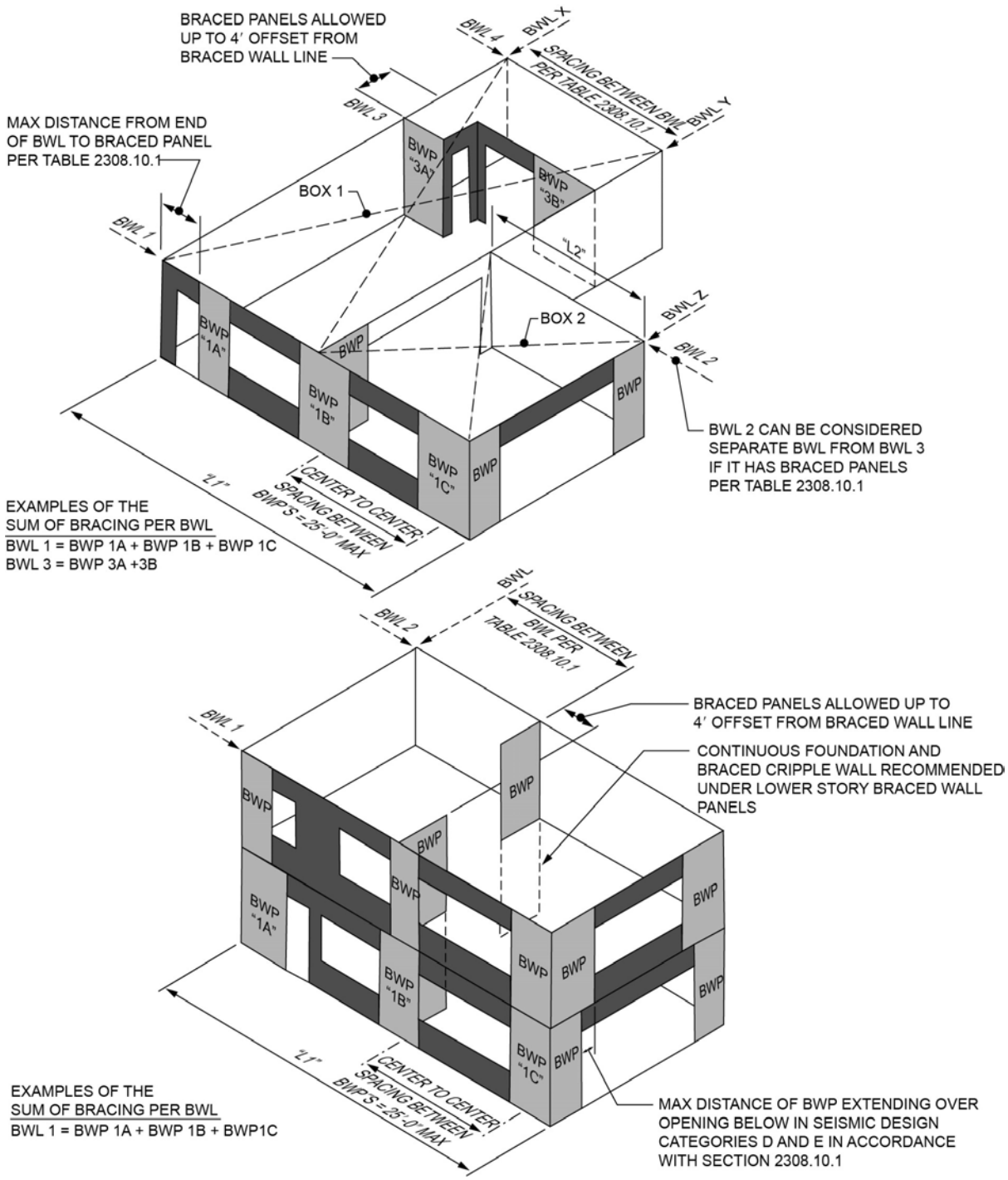
2308.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required along each story level of a building, braced wall lines shall be designated as straight lines through the building plan in both the longitudinal and transverse direction and placed in accordance with Table 2308.10.1 and Figure 2308.10.1. Braced wall line spacing shall not exceed the distance specified in Table 2308.10.1. In structures assigned to Seismic Design Category D or E, braced wall lines shall intersect perpendicularly to each other.

FIGURE 2308.10.1—BASIC COMPONENTS OF THE LATERAL BRACING SYSTEM


BRACED PANELS ALLOWED UP TO 4′ OFFSET FROM BRACED WALL LINE
BWL 4
BWL X
SPACING BETWEEN BWL PER TABLE 2308.10.1
BWL Y
BWL 3
MAX DISTANCE FROM END OF BWL TO BRACED PANEL PER TABLE 2308.10.1
BWP "3A"
BWP "3B"
BOX 1
BWL 1
"L2"
BWL Z
BOX 2
BWL 2
BWP "1A"
BWP
BWP "1B"
BWP "1C"
BWL 2 CAN BE CONSIDERED SEPARATE BWL FROM BWL 3 IF IT HAS BRACED PANELS PER TABLE 2308.10.1
"L1"
CENTER TO CENTER SPACING BETWEEN BWP'S = 25′-0″ MAX
EXAMPLES OF THE SUM OF BRACING PER BWL
BWL 1 = BWP 1A + BWP 1B + BWP 1C
BWL 3 = BWP 3A +3B
BWL 1
SPACING BETWEEN BWL PER TABLE 2308.10.1
BWL 2
BRACED PANELS ALLOWED UP TO 4′ OFFSET FROM BRACED WALL LINE
CONTINUOUS FOUNDATION AND BRACED CRIPPLE WALL RECOMMENDED UNDER LOWER STORY BRACED WALL PANELS
BWL 1
BWP "1A"
BWP "1B"
BWP "1C"
"L1"
CENTER TO CENTER SPACING BETWEEN BWP'S = 25′-0″ MAX
EXAMPLES OF THE SUM OF BRACING PER BWL
BWL 1 = BWP 1A + BWP 1B + BWP1C
MAX DISTANCE OF BWP EXTENDING OVER OPENING BELOW IN SEISMIC DESIGN CATEGORIES D AND E IN ACCORDANCE WITH SECTION 2308.10.1

For SI: 1 foot = 304.8 mm.

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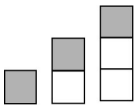
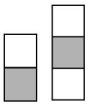
TABLE 2308.10.1—WALL BRACING REQUIREMENTS[a]

SEISMIC DESIGN CATEGORY	STORY CONDITION (SEE SECTION 2308.2)	MAXIMUM SPACING OF BRACED WALL LINES	BRACED PANEL LOCATION, SPACING (O.C.) AND MINIMUM PERCENTAGE (X)			MAXIMUM DISTANCE OF BRACED WALL PANELS FROM EACH END OF BRACED WALL LINE
			Bracing method[b]			
			LIB	DWB, WSP	SFB, PBS, PCP, HPS, GB[c, d]	
A and B		35′ - 0″	Each end and ≤ 25′- 0″ o.c.	Each end and ≤ 25′- 0″ o.c.	Each end and ≤ 25′- 0″ o.c.	12′- 6″
		35′- 0″	Each end and ≤ 25′- 0″ o.c.	Each end and ≤ 25′- 0″ o.c.	Each end and ≤ 25′- 0″ o.c.	12′- 6″
		35′- 0″	NP	Each end and ≤ 25′- 0″ o.c.	Each end and ≤ 25′- 0″ o.c.	12′- 6″
C		35′- 0″	NP	Each end and ≤ 25′- 0″ o.c.	Each end and ≤ 25′- 0″ o.c.	12′- 6″
		35′- 0″	NP	Each end and ≤ 25′- 0″ o.c. (minimum 25% of wall length)[e]	Each end and ≤ 25′- 0″ o.c. (minimum 25% of wall length)[e]	12′- 6″
D and E		25′- 0″	NP	S_{DS} < 0.50: Each end and ≤ 25′- 0″ o.c. (minimum 21% of wall length)[e]	S_{DS} < 0.50: Each end and ≤ 25′- 0″ o.c. (minimum 43% of wall length)[e]	8′- 0″
				0.5 ≤ S_{DS} < 0.75: Each end and ≤ 25′- 0″ o.c. (minimum 32% of wall length)[e]	0.5 ≤ S_{DS}< 0.75: Each end and ≤ 25′- 0″ o.c. (minimum 59% of wall length)[e]	
				0.75 ≤ S_{DS} ≤ 1.00: Each end and ≤ 25′- 0″ o.c. (minimum 37% of wall length)[e]	0.75 ≤ S_{DS} ≤ 1.00: Each end and ≤ 25′- 0″ o.c. (minimum 75% of wall length)	
				S_{DS} > 1.00: Each end and ≤ 25′- 0″ o.c. (minimum 48% of wall length)[e]	S_{DS} > 1.00: Each end and ≤ 25′- 0″ o.c. (minimum 100% of wall length)[e]	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
NP = Not Permitted.
a. This table specifies minimum requirements for braced wall panels along interior or exterior braced wall lines.
b. See Section 2308.10.3 for full description of bracing methods.
c. For Method GB, gypsum wallboard applied to framing supports that are spaced at 16 inches on center.
d. The required lengths shall be doubled for gypsum board applied to only one face of a braced wall panel.
e. Percentage shown represents the minimum amount of bracing required along the building length (or wall length if the structure has an irregular shape).

2308.10.2 Braced wall panels. Braced wall panels shall be placed along braced wall lines in accordance with Table 2308.10.1 and Figure 2308.10.1 and as specified in Table 2308.10.3(1). A braced wall panel shall be located at each end of the braced wall line and at the corners of intersecting braced wall lines or shall begin within the maximum distance from the end of the braced wall line in accordance with Table 2308.10.1. Braced wall panels in a braced wall line shall not be offset from each other by more than 4 feet (1219 mm). Braced wall panels shall be clearly indicated on the plans.

2308.10.3 Braced wall panel methods. Construction of braced wall panels shall be by one or a combination of the methods in Table 2308.10.3(1). Braced wall panel length shall be in accordance with Section 2308.10.4 or 2308.10.5.

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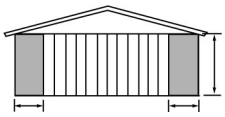
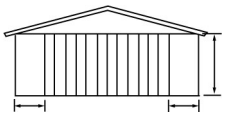
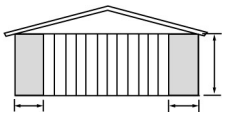
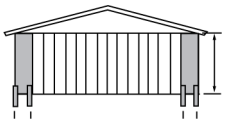
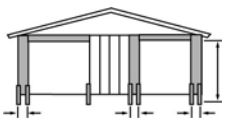
TABLE 2308.10.3(1)—BRACING METHODS

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a]	
			Fasteners	Spacing
LIB[a] Let-in-bracing	1″ × 4″ wood or approved metal straps attached at 45° to 60° angles to studs at maximum of 16″ o.c.	5	Table 2304.10.2	Wood: per stud plus top and bottom plates
			Metal strap: installed in accordance with manufacturer's recommendations	Metal strap: installed in accordance with manufacturer's recommendations
DWB Diagonal wood boards	$^3/_4$″ thick (1″ nominal) × 6″ minimum width to studs at maximum of 24″ o.c.		Table 2304.10.2	Per stud
WSP Wood structural panel	$^3/_8$″ in accordance with Table 2308.10.3(2) or 2308.10.3(3)		Table 2304.10.2	6″ edges 12″ field
SFB Structural fiberboard sheathing	$^1/_2$″ in accordance with Table 2304.10.2 to studs at maximum 16″ o.c.		Table 2304.10.2	3″ edges 6″ field
GB Gypsum board (Double sided)	$^1/_2$″ or $^5/_8$″ by not less than 4′ wide to studs at maximum of 24” o.c.		Section 2506.2 for exterior and interior sheathing: 5d cooler nails ($1^5/_8$″ × 0.086″) or $1^1/_4$″ screws (Type W or S) for $^1/_2$″ gypsum board or $1^5/_8$″ screws (Type W or S) for $^5/_8$″ gypsum board	For all braced wall panel locations: 7″ o.c. along panel edges (including top and bottom plates) and 7” o.c. in the field
PBS Particleboard sheathing	$^3/_8$″ or $^1/_2$″ in accordance with Table 2308.10.3(4) to studs at maximum of 16″ o.c.		6d common (2″ long × 0.113″ dia.) nails for $^3/_8$″ thick sheathing or 8d common ($2^1/_2$″ long × 0.131″ dia.) nails for $^1/_2$″ thick sheathing	3″ edges 6″ field
PCP Portland cement plaster	Section 2510 to studs at maximum of 16″ o.c.		$1^1/_2$″ long, 11 gage, 0.120" dia., $^7/_{16}$″ dia. head nails or $^7/_8$″ long, 16 gage staples	6″ o.c. on all framing members
HPS Hardboard panel siding	$^7/_{16}$″ in accordance with Table 2308.10.3(5)		Table 2304.10.2	4″ edges 8″ field
ABW Alternate braced wall	$^3/_8$″		Figure 2308.10.5.1 and Section 2308.10.5.1	Figure 2308.10.5.1
PFH Portal frame with hold-downs	$^3/_8$″		Figure 2308.10.5.2 and Section 2308.10.5.2	Figure 2308.10.5.2

For SI: 1 foot = 304.8 mm, 1 degree = 0.01745 rad.

a. Method LIB shall have gypsum board fastened to one or more side(s) with nails or screws

TABLE 2308.10.3(2)—EXPOSED PLYWOOD PANEL SIDING

MINIMUM THICKNESS[a] (inch)	MINIMUM NUMBER OF PLIES	STUD SPACING (inches) Plywood siding applied directly to studs or over sheathing
3/8	3	16[b]
1/2	4	24

For SI: 1 inch = 25.4 mm.

a. Thickness of grooved panels is measured at bottom of grooves.

b. Spans are permitted to be 24 inches if plywood siding applied with face grain perpendicular to studs or over one of the following: 1-inch board sheathing; 7/16-inch wood structural panel sheathing; or 3/8-inch wood structural panel sheathing with strength axis (which is the long direction of the panel unless otherwise marked) of sheathing perpendicular to studs.

TABLE 2308.10.3(3)—WOOD STRUCTURAL PANEL WALL SHEATHING[b]
(Not exposed to the weather, strength axis parallel or perpendicular to studs except as indicated)

MINIMUM THICKNESS (inch)	PANEL SPAN RATING	STUD SPACING (inches)		
		Siding nailed to studs	Nailable sheathing	
			Sheathing parallel to studs	Sheathing perpendicular to studs
3/8, 15/32, 1/2	16/0, 20/0, 24/0, 32/16 Wall—24″ o.c.	24	16	24
7/16, 15/32, 1/2	24/0, 24/16, 32/16 Wall—24″ o.c.	24	24[a]	24

For SI: 1 inch = 25.4 mm.

a. Plywood shall consist of four or more plies.

b. Blocking of horizontal joints shall not be required except as specified in Section 2308.10.4.

TABLE 2308.10.3(4)—ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING
(Not exposed to the weather, long dimension of the panel parallel or perpendicular to studs)

GRADE	THICKNESS (inch)	STUD SPACING (inches)	
		Siding nailed to studs	Sheathing under coverings specified in Section 2308.10.3 parallel or perpendicular to studs
M-S “Exterior Glue” and M-2 “Exterior Glue”	3/8	16	—
	1/2	16	16

For SI: 1 inch = 25.4 mm.

TABLE 2308.10.3(5)—HARDBOARD SIDING

SIDING	MINIMUM NOMINAL THICKNESS (inch)	2 × 4 FRAMING MAXIMUM SPACING	NAIL SIZE[a, b, d]	NAIL SPACING	
				General	Bracing panels[c]
1. Lap siding					
Direct to studs	3/8	16″ o.c.	8d	16″ o.c.	Not applicable
Over sheathing	3/8	16″ o.c.	10d	16″ o.c.	Not applicable
2. Square edge panel siding					
Direct to studs	3/8	24″ o.c.	6d	6″ o.c. edges; 12″ o.c. at intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports
Over sheathing	3/8	24″ o.c.	8d	6″ o.c. edges; 12″ o.c. at intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports
3. Shiplap edge panel siding					
Direct to studs	3/8	16″ o.c.	6d	6″ o.c. edges; 12″ o.c. at intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports
Over sheathing	3/8	16″ o.c.	8d	6″ o.c. edges; 12″ o.c. at intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

a. Nails shall be corrosion resistant.

b. Minimum acceptable nail dimensions.

	Panel Siding (inch)	Lap Siding (inch)
Shank diameter	0.092	0.099
Head diameter	0.225	0.240

c. Where used to comply with Section 2308.10.

d. Nail length must accommodate the sheathing and penetrate framing 1 1/2 inches.

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2308.10.4 Braced wall panel construction. For Methods DWB, WSP, SFB, PBS, PCP and HPS, each panel must be not less than 48 inches (1219 mm) in length, covering three stud spaces where studs are spaced 16 inches (406 mm) on center and covering two stud spaces where studs are spaced 24 inches (610 mm) on center. Braced wall panels less than 48 inches (1219 mm) in length shall not contribute toward the amount of required bracing. Braced wall panels that are longer than the required length shall be credited for their actual length. For Method GB, each panel must be not less than 96 inches (2438 mm) in length where applied to one side of the studs or 48 inches (1219 mm) in length where applied to both sides.

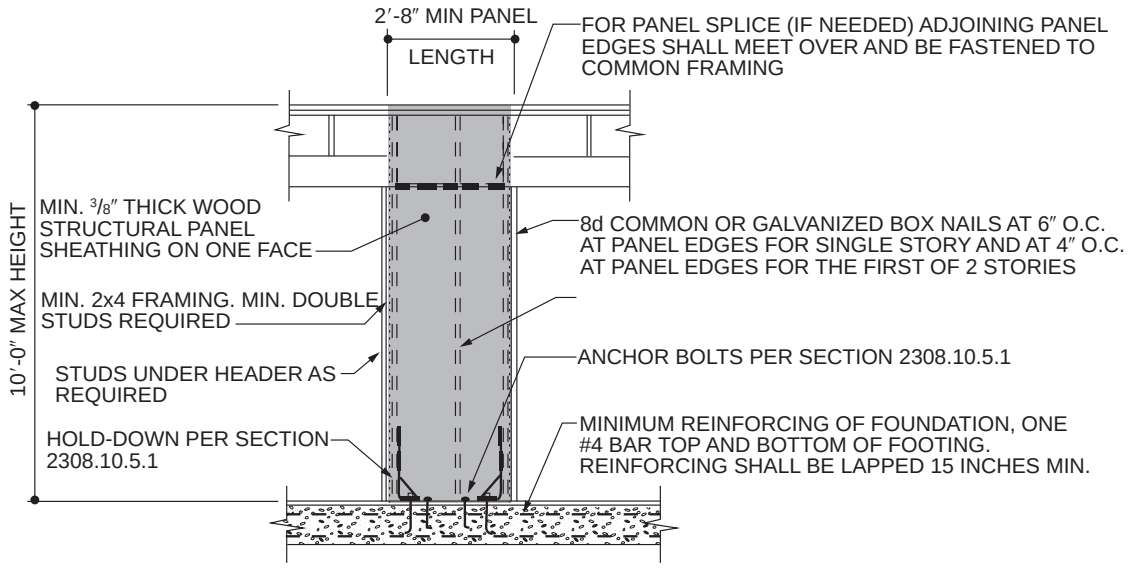
Vertical joints of panel sheathing shall occur over studs and adjacent panel joints shall be nailed to common framing members. Horizontal joints shall occur over blocking or other framing equal in size to the studs except where waived by the installation requirements for the specific sheathing materials. Sole plates shall be nailed to the floor framing in accordance with Section 2308.10.7 and top plates shall be connected to the framing above in accordance with Section 2308.10.7.2. Where joists are perpendicular to braced wall lines above, blocking shall be provided under and in line with the braced wall panels.

2308.10.5 Alternative bracing. An alternate braced wall (ABW) or a portal frame with hold-downs (PFH) described in this section is permitted to substitute for a 48-inch (1219 mm) braced wall panel of Method DWB, WSP, SFB, PBS, PCP or HPS. For Method GB, each 96-inch (2438 mm) section (applied to one face) or 48-inch (1219 mm) section (applied to both faces) or portion thereof required by Table 2308.10.1 is permitted to be replaced by one panel constructed in accordance with Method ABW or PFH.

2308.10.5.1 Alternate braced wall (ABW). An ABW shall be constructed in accordance with this section and Figure 2308.10.5.1. In one-story buildings, each panel shall have a length of not less than 2 feet 8 inches (813 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with $^{3}/_{8}$-inch (3.2 mm) minimum-thickness wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Table 2304.10.2 and blocked at wood structural panel edges. Two anchor bolts installed in accordance with Section 2308.7.1 shall be provided in each panel. Anchor bolts shall be placed at each panel outside quarter points. Each panel end stud shall have a hold-down device fastened to the foundation, capable of providing an approved uplift capacity of not less than 1,800 pounds (8006 N). The hold-down device shall be installed in accordance with the manufacturer's recommendations. The ABW shall be supported directly on a foundation or on floor framing supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom. Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned-down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned-down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

Where the ABW is installed at the first story of two-story buildings, the wood structural panel sheathing shall be provided on both faces, three anchor bolts shall be placed at one-quarter points and tie-down device uplift capacity shall be not less than 3,000 pounds (13 344 N).

FIGURE 2308.10.5.1—ALTERNATE BRACED WALL PANEL (ABW)


2′-8″ MIN PANEL
LENGTH
FOR PANEL SPLICE (IF NEEDED) ADJOINING PANEL EDGES SHALL MEET OVER AND BE FASTENED TO COMMON FRAMING
10′-0″ MAX HEIGHT
MIN. 3/8″ THICK WOOD STRUCTURAL PANEL SHEATHING ON ONE FACE
8d COMMON OR GALVANIZED BOX NAILS AT 6″ O.C. AT PANEL EDGES FOR SINGLE STORY AND AT 4″ O.C. AT PANEL EDGES FOR THE FIRST OF 2 STORIES
MIN. 2x4 FRAMING. MIN. DOUBLE STUDS REQUIRED
ANCHOR BOLTS PER SECTION 2308.10.5.1
STUDS UNDER HEADER AS REQUIRED
HOLD-DOWN PER SECTION 2308.10.5.1
MINIMUM REINFORCING OF FOUNDATION, ONE #4 BAR TOP AND BOTTOM OF FOOTING. REINFORCING SHALL BE LAPPED 15 INCHES MIN.

For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.

2308.10.5.2 Portal frame with hold-downs (PFH). A PFH shall be constructed in accordance with this section and Figure 2308.10.5.2. The adjacent door or window opening shall have a full-length header.

In one-story buildings, each panel shall have a length of not less than 16 inches (406 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with a single layer of $^{3}/_{8}$-inch (9.5 mm) minimum-thickness wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Figure 2308.10.5.2. The wood structural panel sheathing shall extend up over the solid sawn or glued-laminated header and shall be nailed in accordance

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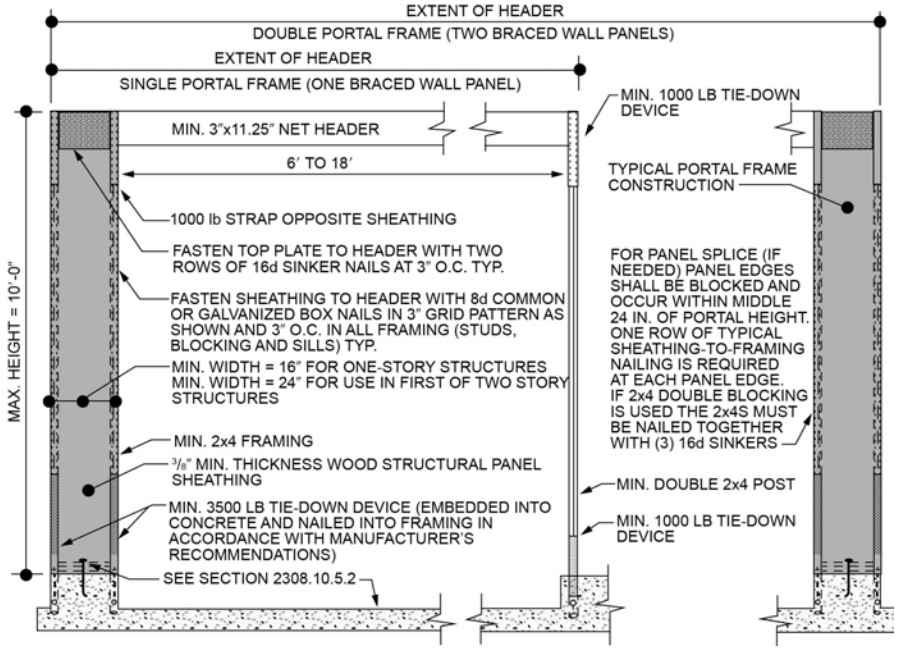
with Figure 2308.10.5.2. A built-up header consisting of not fewer than two 2-inch by 12-inch (51 mm by 305 mm) boards, fastened in accordance with Item 24 of Table 2304.10.2 shall be permitted to be used. A spacer, if used, shall be placed on the side of the built-up beam opposite the wood structural panel sheathing. The header shall extend between the inside faces of the first full-length outer studs of each panel. The clear span of the header between the inner studs of each panel shall be not less than 6 feet (1829 mm) and not more than 18 feet (5486 mm) in length. A strap with an uplift capacity of not less than 1,000 pounds (4,400 N) shall fasten the header to the inner studs opposite the sheathing. One anchor bolt not less than $^{5}/_{8}$ inch (15.9 mm) diameter and installed in accordance with Section 2308.7.1 shall be provided in the center of each sill plate. The studs at each end of the panel shall have a hold-down device fastened to the foundation with an uplift capacity of not less than 3,500 pounds (15 570 N).

Where a panel is located on one side of the opening, the header shall extend between the inside face of the first full-length stud of the panel and the bearing studs at the other end of the opening. A strap with an uplift capacity of not less than 1,000 pounds (4400 N) shall fasten the header to the bearing studs. The bearing studs shall have a hold-down device fastened to the foundation with an uplift capacity of not less than 1,000 pounds (4400 N). The hold-down devices shall be an embedded strap type, installed in accordance with the manufacturer's recommendations. The PFH panels shall be supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom. Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned-down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned-down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped not less than 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

Where a PFH is installed at the first story of two-story buildings, each panel shall have a length of not less than 24 inches (610 mm).

FIGURE 2308.10.5.2—PORTAL FRAME WITH HOLD-DOWNS (PFH)


EXTENT OF HEADER
DOUBLE PORTAL FRAME (TWO BRACED WALL PANELS)
EXTENT OF HEADER
SINGLE PORTAL FRAME (ONE BRACED WALL PANEL)
MIN. 1000 LB TIE-DOWN DEVICE
MIN. 3"x11.25" NET HEADER
6' TO 18'
TYPICAL PORTAL FRAME CONSTRUCTION
1000 lb STRAP OPPOSITE SHEATHING
FASTEN TOP PLATE TO HEADER WITH TWO ROWS OF 16d SINKER NAILS AT 3" O.C. TYP.
FOR PANEL SPLICE (IF NEEDED) PANEL EDGES SHALL BE BLOCKED AND OCCUR WITHIN MIDDLE 24 IN. OF PORTAL HEIGHT. ONE ROW OF TYPICAL SHEATHING-TO-FRAMING NAILING IS REQUIRED AT EACH PANEL EDGE. IF 2x4 DOUBLE BLOCKING IS USED THE 2x4S MUST BE NAILED TOGETHER WITH (3) 16d SINKERS
FASTEN SHEATHING TO HEADER WITH 8d COMMON OR GALVANIZED BOX NAILS IN 3" GRID PATTERN AS SHOWN AND 3" O.C. IN ALL FRAMING (STUDS, BLOCKING AND SILLS) TYP.
MAX. HEIGHT = 10'-0"
MIN. WIDTH = 16" FOR ONE-STORY STRUCTURES
MIN. WIDTH = 24" FOR USE IN FIRST OF TWO STORY STRUCTURES
MIN. 2x4 FRAMING
3/8" MIN. THICKNESS WOOD STRUCTURAL PANEL SHEATHING
MIN. DOUBLE 2x4 POST
MIN. 3500 LB TIE-DOWN DEVICE (EMBEDDED INTO CONCRETE AND NAILED INTO FRAMING IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS)
MIN. 1000 LB TIE-DOWN DEVICE
SEE SECTION 2308.10.5.2

For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

2308.10.6 Cripple wall bracing. Cripple walls shall be braced in accordance with Section 2308.10.6.1 or 2308.10.6.2.

2308.10.6.1 Cripple wall bracing in Seismic Design Categories A, B and C. For the purposes of this section, cripple walls in Seismic Design Categories A, B and C having a stud height exceeding 14 inches (356 mm) shall be considered to be a story and shall be braced in accordance with Table 2308.10.1. Spacing of edge nailing for required cripple wall bracing shall not exceed 6 inches (152 mm) on center along the foundation plate and the top plate of the cripple wall. Nail size, nail spacing for field nailing and more restrictive boundary nailing requirements shall be as required elsewhere in the code for the specific bracing material used.

2308.10.6.2 Cripple wall bracing in Seismic Design Categories D and E. For the purposes of this section, cripple walls in Seismic Design Categories D and E shall not have a stud height exceeding 14 inches (356 mm), and studs shall be solid blocked in accordance with Section 2308.9.6 for the full dwelling perimeter and for the full length of interior braced walls lines supported on foundations, excepting ventilation and access openings.

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2308.10.7 Connections of braced wall panels. Braced wall panel joints shall occur over studs or blocking. Braced wall panels shall be fastened to studs, top and bottom plates and at panel edges. Braced wall panels shall be applied to nominal 2-inch-wide [actual $1^1/_2$-inch (38 mm)] or larger stud framing.

2308.10.7.1 Bottom plate connection. Braced wall line bottom plates shall be connected to joists or full-depth blocking below in accordance with Table 2304.10.2, or to foundations in accordance with Section 2308.10.7.3.

2308.10.7.2 Top plate connection. Where joists or rafters are used, braced wall line top plates shall be fastened over the full length of the braced wall line to joists, rafters, rim boards or full-depth blocking above in accordance with Table 2304.10.2, as applicable, based on the orientation of the joists or rafters to the braced wall line. Blocking shall be not less than 2 inches (51 mm) in nominal thickness and shall be fastened to the braced wall line top plate as specified in Table 2304.10.2. Notching or drilling of holes in blocking in accordance with the requirements of Section 2308.6 shall be permitted.

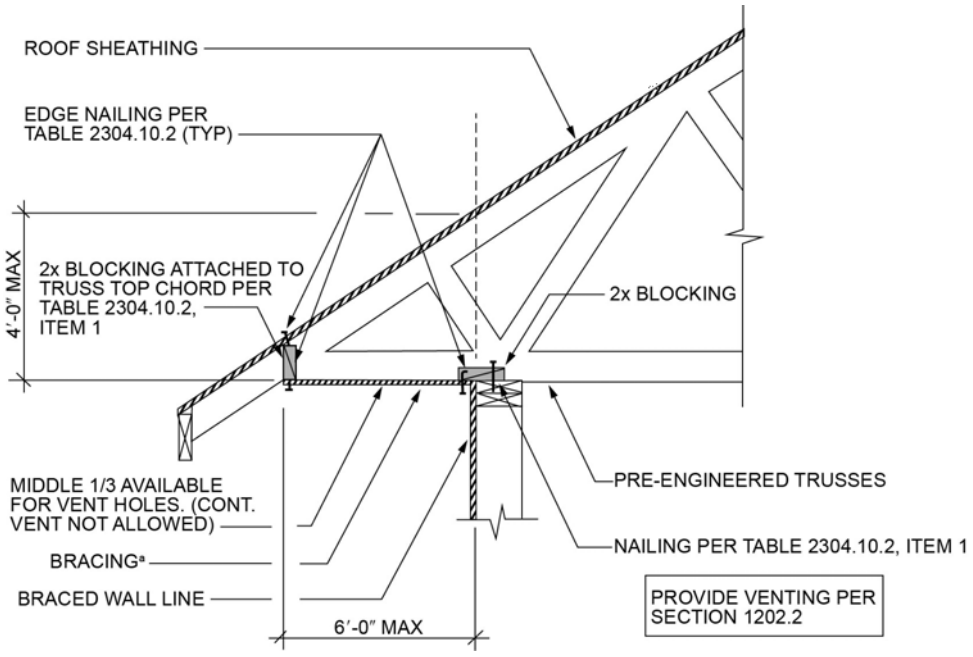
At exterior gable end walls, braced wall panel sheathing in the top story shall be extended and fastened to the roof framing where the spacing between parallel exterior braced wall lines is greater than 50 feet (15 240 mm).

Where roof trusses are used and are installed perpendicular to an exterior braced wall line, lateral forces shall be transferred from the roof diaphragm to the braced wall over the full length of the braced wall line by blocking of the ends of the trusses or by other approved methods providing equivalent lateral force transfer. Blocking shall be not less than 2 inches (51 mm) in nominal thickness and equal to the depth of the truss at the wall line and shall be fastened to the braced wall line top plate as specified in Table 2304.10.2. Notching or drilling of holes in blocking in accordance with the requirements of Section 2308.6 shall be permitted.

Exception: Where the roof sheathing is greater than $9^1/_4$ inches (235 mm) above the top plate, solid blocking is not required where the framing members are connected using one of the following methods:

1. In accordance with Figure 2308.10.7.2(1).
2. In accordance with Figure 2308.10.7.2(2).
3. Full-height engineered blocking panels designed for values listed in AWC WFCM.
4. A design in accordance with accepted engineering methods.

FIGURE 2308.10.7.2(1)—BRACED WALL LINE TOP PLATE CONNECTION


ROOF SHEATHING
EDGE NAILING PER TABLE 2304.10.2 (TYP)
4′-0″ MAX
2x BLOCKING ATTACHED TO TRUSS TOP CHORD PER TABLE 2304.10.2, ITEM 1
2x BLOCKING
MIDDLE 1/3 AVAILABLE FOR VENT HOLES. (CONT. VENT NOT ALLOWED)
BRACING[a]
BRACED WALL LINE
6′-0″ MAX
PRE-ENGINEERED TRUSSES
NAILING PER TABLE 2304.10.2, ITEM 1
PROVIDE VENTING PER SECTION 1202.2

For SI:1 foot = 304.8 mm. a. Methods of bracing shall be as described in Table 2308.10.3(1) DWB, WSP, SFB, GB, PBS, PCP or HPS.

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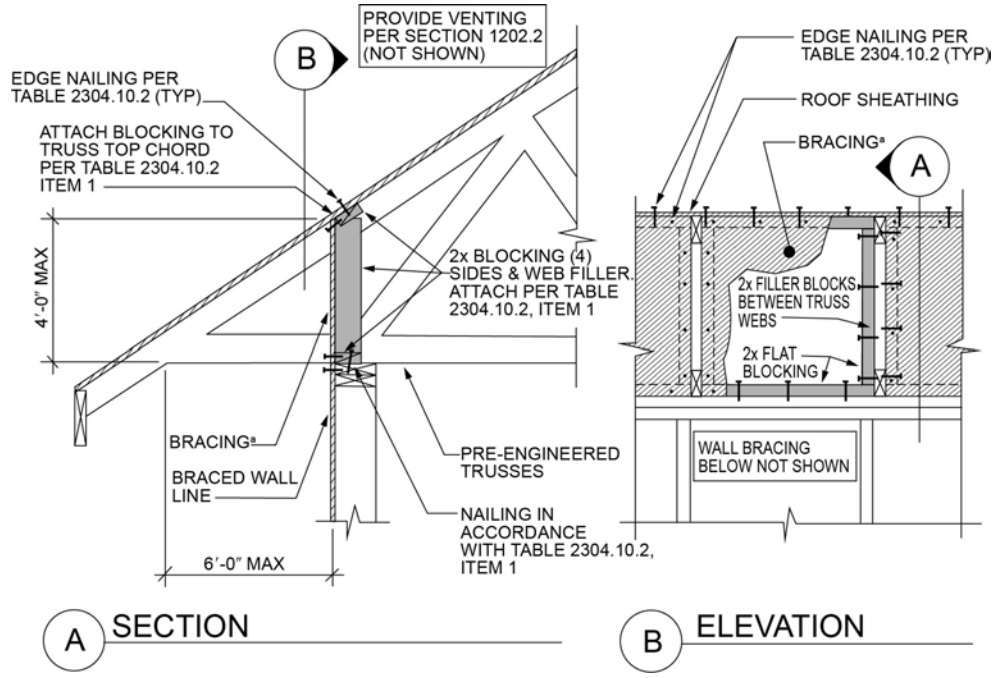
FIGURE 2308.10.7.2(2)—BRACED WALL PANEL TOP PLATE CONNECTION


PROVIDE VENTING PER SECTION 1202.2 (NOT SHOWN)
B
EDGE NAILING PER TABLE 2304.10.2 (TYP)
ATTACH BLOCKING TO TRUSS TOP CHORD PER TABLE 2304.10.2 ITEM 1
4'-0" MAX
2x BLOCKING (4) SIDES & WEB FILLER, ATTACH PER TABLE 2304.10.2, ITEM 1
BRACING[a]
BRACED WALL LINE
PRE-ENGINEERED TRUSSES
NAILING IN ACCORDANCE WITH TABLE 2304.10.2, ITEM 1
6'-0" MAX
A SECTION
EDGE NAILING PER TABLE 2304.10.2 (TYP)
ROOF SHEATHING
BRACING[a]
A
2x FILLER BLOCKS BETWEEN TRUSS WEBS
2x FLAT BLOCKING
WALL BRACING BELOW NOT SHOWN
B ELEVATION

For SI:1 foot = 304.8 mm. a. Methods of bracing shall be as described in Table 2308.10.3(1) DWB, WSP, SFB, GB, PBS, PCP or HPS.

2308.10.7.3 Sill anchorage. Where foundations are required by Section 2308.10.8, braced wall line sills shall be anchored to concrete or masonry foundations. Such anchorage shall conform to the requirements of Section 2308.7. The anchors shall be distributed along the length of the braced wall line. Other anchorage devices having equivalent capacity are permitted.

2308.10.7.4 Anchorage to all-wood foundations. Where all-wood foundations are used, the force transfer from the braced wall lines shall be determined based on calculation and shall have a capacity that is not less than the connections required by Section 2308.7.

2308.10.8 Braced wall line and diaphragm support. Braced wall lines and floor and roof diaphragms shall be supported in accordance with this section.

2308.10.8.1 Foundation requirements. Braced wall lines shall be supported by continuous foundations.

Exception: For structures with a maximum plan dimension not more than 50 feet (15 240 mm), continuous foundations are required at exterior walls only.

For structures in Seismic Design Categories D and E, exterior braced wall panels shall be in the same plane vertically with the foundation or the portion of the structure containing the offset shall be designed in accordance with accepted engineering practice and Section 2308.3.

Exceptions:

1. Exterior braced wall panels shall be permitted to be located not more than 4 feet (1219 mm) from the foundation below where supported by a floor constructed in accordance with all of the following:
   1.1. Cantilevers or setbacks shall not exceed four times the nominal depth of the floor joists.
   1.2. Floor joists shall be 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
   1.3. The ratio of the back span to the cantilever shall be not less than 2 to 1.
   1.4. Floor joists at ends of braced wall panels shall be doubled.
   1.5. A continuous rim joist shall be connected to the ends of cantilevered joists. The rim joist is permitted to be spliced using a metal tie not less than 0.058 inch (1.47 mm) (16 galvanized gage) and $1^1/_2$ inches (38 mm) in width fastened with six 16d common nails on each side. The metal tie shall have a yield stress not less than 33,000 psi (227 MPa).
   1.6. Joists at setbacks or the end of cantilevered joists shall not carry gravity loads from more than a single story having uniform wall and roof loads nor carry the reactions from headers having a span of 8 feet (2438 mm) or more.
2. The end of a required braced wall panel shall be allowed to extend not more than 1 foot (305 mm) over an opening in the wall below. This requirement is applicable to braced wall panels offset in plane and braced wall panels offset out of plane as permitted by Exception 1. Braced wall panels are permitted to extend over an opening not more than 8 feet (2438 mm) in width where the header is a 4-inch by 12-inch (102 mm by 305 mm) or larger member.

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2308.10.8.2 Floor and roof diaphragm support in Seismic Design Categories D and E. In structures assigned to Seismic Design Categories D or E, floor and roof diaphragms shall be laterally supported by braced wall lines on all edges and connected in accordance with Section 2308.10.7 [see Figure 2308.10.8.2(1)].

Exception: Portions of roofs or floors that do not support braced wall panels above are permitted to extend up to 6 feet (1829 mm) beyond a braced wall line [see Figure 2308.10.8.2(2)] provided that the framing members are connected to the braced wall line below in accordance with Section 2308.10.7.

FIGURE 2308.10.8.2(1)—ROOF IN SDC D OR E NOT SUPPORTED ON ALL EDGES

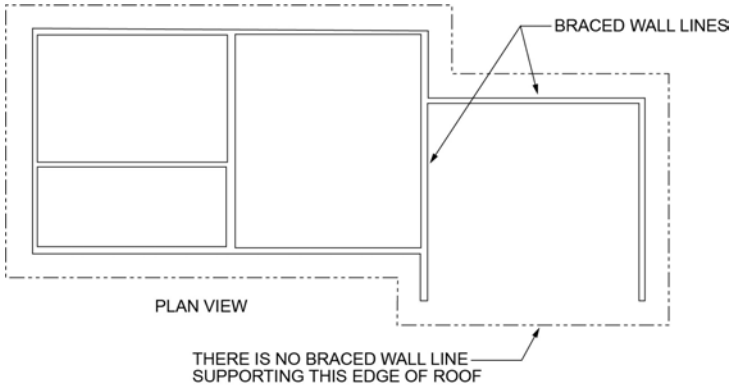
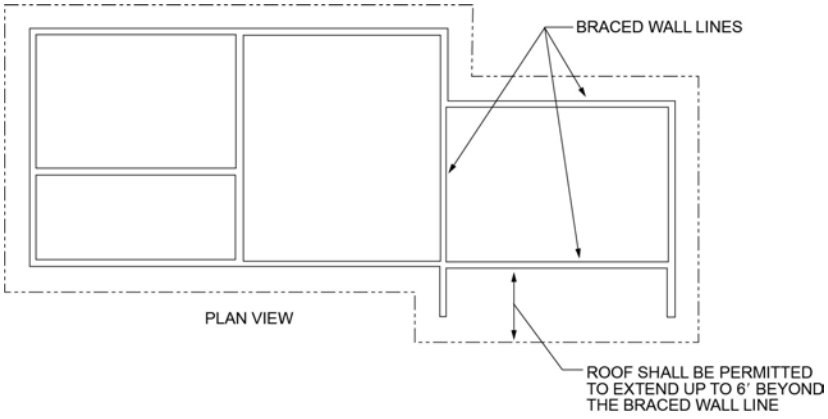


FIGURE 2308.10.8.2(2)—ROOF EXTENSION IN SDC D OR E BEYOND BRACED WALL LINE



For SI: 1 foot = 304.8 mm.

2308.10.8.3 Stepped footings in Seismic Design Categories B, C, D and E. In Seismic Design Categories B, C, D and E, where the height of a required braced wall panel extending from foundation to floor above varies more than 4 feet (1219 mm), the following construction shall be used:

1. Where the bottom of the footing is stepped and the lowest floor framing rests directly on a sill bolted to the footings, the sill shall be anchored as required in Section 2308.7.
2. Where the lowest floor framing rests directly on a sill bolted to a footing not less than 8 feet (2438 mm) in length along a line of bracing, the line shall be considered to be braced. The double plate of the cripple stud wall beyond the segment of footing extending to the lowest framed floor shall be spliced to the sill plate with metal ties, one on each side of the sill and plate. The metal ties shall be not less than 0.058 inch [1.47 mm (16 galvanized gage)] by $1^1/_2$ inches (38 mm) in width by 48 inches (1219 mm) with eight 16d common nails on each side of the splice location (see Figure 2308.10.8.3). The metal tie shall have a yield stress not less than 33,000 pounds per square inch (psi) (227 MPa).
3. Where cripple walls occur between the top of the footing and the lowest floor framing, the bracing requirements for a story shall apply.

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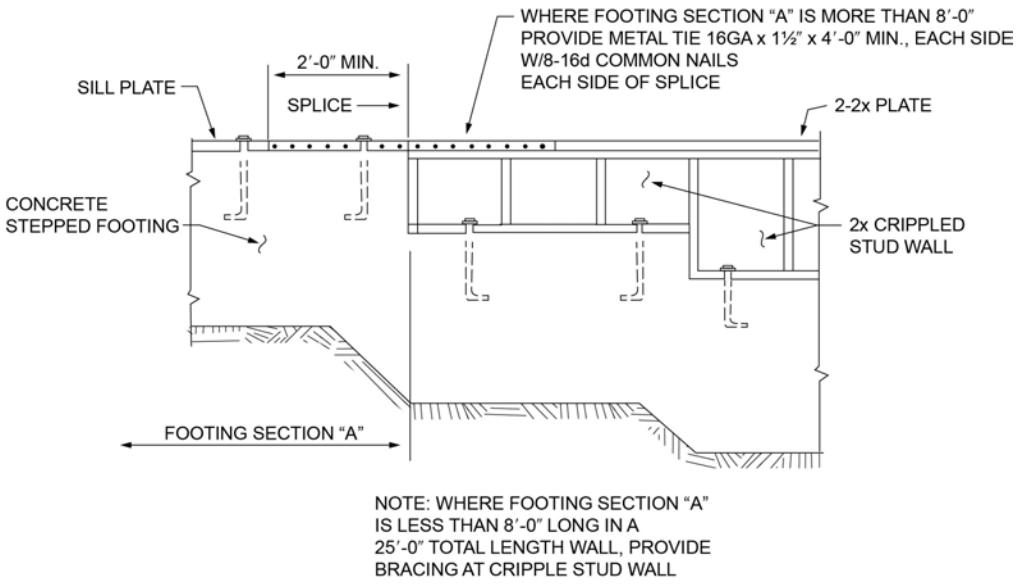
FIGURE 2308.10.8.3—STEPPED FOOTING CONNECTION DETAILS



For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.

2308.10.9 Attachment of sheathing. Fastening of braced wall panel sheathing shall be not less than that prescribed in Tables 2308.10.1 and 2304.10.2. Wall sheathing shall not be attached to framing members by adhesives.

2308.10.10 Limitations of concrete or masonry veneer. Concrete or masonry veneer shall comply with Chapter 14 and this section.

2308.10.10.1 Limitations of concrete or masonry veneer in Seismic Design Category B or C. In Seismic Design Categories B and C, concrete or masonry walls and stone or masonry veneer shall not extend above a basement.

Exceptions:

1. In structures assigned to Seismic Design Category B, stone and masonry veneer is permitted to be used in the first two stories above grade plane or the first three stories above grade plane where the lowest story has concrete or masonry walls, provided that wood structural panel wall bracing is used and the length of bracing provided is one and one-half times the required length specified in Table 2308.10.1.
2. Stone and masonry veneer is permitted to be used in the first story above grade plane or the first two stories above grade plane where the lowest story has concrete or masonry walls.
3. Stone and masonry veneer is permitted to be used in both stories of buildings with two stories above grade plane, provided that the following criteria are met:
   - 3.1. Type of brace in accordance with Section 2308.10.1 shall be WSP and the allowable shear capacity in accordance with Section 2306.3 shall be not less than 350 plf (5108 N/m).
   - 3.2. Braced wall panels in the second story shall be located in accordance with Section 2308.10.1 and not more than 25 feet (7620 mm) on center, and the total length of braced wall panels shall be not less than 25 percent of the braced wall line length. Braced wall panels in the first story shall be located in accordance with Section 2308.10.1 and not more than 25 feet (7620 mm) on center, and the total length of braced wall panels shall be not less than 45 percent of the braced wall line length.
   - 3.3. Hold-down connectors with an allowable capacity of 2,000 pounds (8896 N) shall be provided at the ends of each braced wall panel for the second story to the first story connection. Hold-down connectors with an allowable capacity of 3,900 pounds (17 347 N) shall be provided at the ends of each braced wall panel for the first story to the foundation connection. In all cases, the hold-down connector force shall be transferred to the foundation.
   - 3.4. Cripple walls shall not be permitted.

2308.10.10.2 Limitations of concrete or masonry in Seismic Design Categories D and E. In Seismic Design Categories D and E, concrete or masonry walls and stone or masonry veneer shall not extend above a basement.

Exception: In structures assigned to Seismic Design Category D, stone and masonry veneer is permitted to be used in the first story above grade plane, provided that the following criteria are met:

1. Type of brace in accordance with Section 2308.10.1 shall be WSP and the allowable shear capacity in accordance with Section 2306.3 shall be not less than 350 plf (5108 N/m).

2. The braced wall panels in the first story shall be located at each end of the braced wall line and not more than 25 feet (7620 mm) on center, and the total length of braced wall panels shall be not less than 45 percent of the braced wall line length.
3. Hold-down connectors shall be provided at the ends of braced walls for the first floor to foundation with an allowable capacity of 2,100 pounds (9341 N).
4. Cripple walls shall not be permitted.

2308.11 Roof and ceiling framing. The framing details required in this section apply to roofs having a slope of not less than three units vertical in 12 units horizontal (25-percent slope). Where the roof slope is less than three units vertical in 12 units horizontal (25-percent slope), members supporting rafters and ceiling joists such as ridge board, hips and valleys shall be designed as beams.

2308.11.1 Ceiling joist spans. Spans for ceiling joists shall be in accordance with Table 2308.11.1(1) or 2308.11.1(2). For other grades and species, and other loading conditions, refer to the AWC STJR.

TABLE 2308.11.1(1)—CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	13-2	20-8	Note a	Note a
	Douglas Fir-Larch	#1	12-8	19-11	Note a	Note a
	Douglas Fir-Larch	#2	12-5	19-6	25-8	Note a
	Douglas Fir-Larch	#3	10-10	15-10	20-1	24-6
	Hem-Fir	SS	12-5	19-6	25-8	Note a
	Hem-Fir	#1	12-2	19-1	25-2	Note a
	Hem-Fir	#2	11-7	18-2	24-0	Note a
	Hem-Fir	#3	10-10	15-10	20-1	24-6
	Southern Pine	SS	12-11	20-3	Note a	Note a
	Southern Pine	#1	12-5	19-6	25-8	Note a
	Southern Pine	#2	11-10	18-8	24-7	Note a
	Southern Pine	#3	10-1	14-11	18-9	22-9
	Spruce-Pine-Fir	SS	12-2	19-1	25-2	Note a
	Spruce-Pine-Fir	#1	11-10	18-8	24-7	Note a
	Spruce-Pine-Fir	#2	11-10	18-8	24-7	Note a
	Spruce-Pine-Fir	#3	10-10	15-10	20-1	24-6
16	Douglas Fir-Larch	SS	11-11	18-9	24-8	Note a
	Douglas Fir-Larch	#1	11-6	18-1	23-10	Note a
	Douglas Fir-Larch	#2	11-3	17-8	23-0	Note a
	Douglas Fir-Larch	#3	9-5	13-9	17-5	21-3
	Hem-Fir	SS	11-3	17-8	23-4	Note a
	Hem-Fir	#1	11-0	17-4	22-10	Note a
	Hem-Fir	#2	10-6	16-6	21-9	Note a
	Hem-Fir	#3	9-5	13-9	17-5	21-3
	Southern Pine	SS	11-9	18-5	24-3	Note a
	Southern Pine	#1	11-3	17-8	23-4	Note a
	Southern Pine	#2	10-9	16-11	21-7	25-7
	Southern Pine	#3	8-9	12-11	16-3	19-9
	Spruce-Pine-Fir	SS	11-0	17-4	22-10	Note a
	Spruce-Pine-Fir	#1	10-9	16-11	22-4	Note a
	Spruce-Pine-Fir	#2	10-9	16-11	22-4	Note a
	Spruce-Pine-Fir	#3	9-5	13-9	17-5	21-3

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TABLE 2308.11.1(1)—CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)—continued

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	11-3	17-8	23-3	Note a
	Douglas Fir-Larch	#1	10-10	17-0	22-5	Note a
	Douglas Fir-Larch	#2	10-7	16-7	21-0	25-8
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5
	Hem-Fir	SS	10-7	16-8	21-11	Note a
	Hem-Fir	#1	10-4	16-4	21-6	Note a
	Hem-Fir	#2	9-11	15-7	20-6	25-3
	Hem-Fir	#3	8-7	12-6	15-10	19-5
	Southern Pine	SS	11-0	17-4	22-10	Note a
	Southern Pine	#1	10-7	16-8	22-0	Note a
	Southern Pine	#2	10-2	15-7	19-8	23-5
	Southern Pine	#3	8-0	11-9	14-10	18-0
	Spruce-Pine-Fir	SS	10-4	16-4	21-6	Note a
	Spruce-Pine-Fir	#1	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#2	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5
24	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	Note a
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	Note a
	Southern Pine	#1	9-10	15-6	20-5	24-0
	Southern Pine	#2	9-3	13-11	17-7	20-11
	Southern Pine	#3	7-2	10-6	13-3	16-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4

Check sources for availability of lumber in lengths greater than 20 feet.
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
a. Span exceeds 26 feet in length.

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TABLE 2308.11.1(2)—CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	Note a
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	Note a
	Southern Pine	#1	9-10	15-6	20-5	24-0
	Southern Pine	#2	9-3	13-11	17-7	20-11
	Southern Pine	#3	7-2	10-6	13-3	16-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0
	Douglas Fir-Larch	#1	9-1	13-9	17-5	21-3
	Douglas Fir-Larch	#2	8-9	12-10	16-3	19-10
	Douglas Fir-Larch	#3	6-8	9-8	12-4	15-0
	Hem-Fir	SS	8-11	14-1	18-6	23-8
	Hem-Fir	#1	8-9	13-5	16-10	20-8
	Hem-Fir	#2	8-4	12-8	16-0	19-7
	Hem-Fir	#3	6-8	9-8	12-4	15-0
	Southern Pine	SS	9-4	14-7	19-3	24-7
	Southern Pine	#1	8-11	14-0	17-9	20-9
	Southern Pine	#2	8-0	12-0	15-3	18-1
	Southern Pine	#3	6-2	9-2	11-6	14-0
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1
	Spruce-Pine-Fir	#1	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#2	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#3	6-8	9-8	12-4	15-0

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TABLE 2308.11.1(2)—CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)—continued

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-4
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8
	Hem-Fir	SS	8-5	13-3	17-5	22-3
	Hem-Fir	#1	8-3	12-3	15-6	18-11
	Hem-Fir	#2	7-10	11-7	14-8	17-10
	Hem-Fir	#3	6-1	8-10	11-3	13-8
	Southern Pine	SS	8-9	13-9	18-2	23-1
	Southern Pine	#1	8-5	12-9	16-2	18-11
	Southern Pine	#2	7-4	11-0	13-11	16-6
	Southern Pine	#3	5-8	8-4	10-6	12-9
	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-8
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8
24	Douglas Fir-Larch	SS	8-3	13-0	17-1	20-11
	Douglas Fir-Larch	#1	7-8	11-2	14-2	17-4
	Douglas Fir-Larch	#2	7-2	10-6	13-3	16-3
	Douglas Fir-Larch	#3	5-5	7-11	10-0	12-3
	Hem-Fir	SS	7-10	12-3	16-2	20-6
	Hem-Fir	#1	7-6	10-11	13-10	16-11
	Hem-Fir	#2	7-1	10-4	13-1	16-0
	Hem-Fir	#3	5-5	7-11	10-0	12-3
	Southern Pine	SS	8-1	12-9	16-10	21-6
	Southern Pine	#1	7-8	11-5	14-6	16-11
	Southern Pine	#2	6-7	9-10	12-6	14-9
	Southern Pine	#3	5-1	7-5	9-5	11-5
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	19-5
	Spruce-Pine-Fir	#1	7-2	10-6	13-3	16-3
	Spruce-Pine-Fir	#2	7-2	10-6	13-3	16-3
	Spruce-Pine-Fir	#3	5-5	7-11	10-0	12-3

Check sources for availability of lumber in lengths greater than 20 feet.
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
a. Span exceeds 26 feet in length.

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2308.11.2 Rafter spans. Spans for rafters shall be in accordance with Table 2308.11.2(1), 2308.11.2(2), 2308.11.2(3), 2308.11.2(4), 2308.11.2(5) or 2308.11.2(6). For other grades and species and other loading conditions, refer to the AWC STJR. The span of each rafter shall be measured along the horizontal projection of the rafter.

TABLE 2308.11.2(1)—RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	23-5	Note b	Note b
	Douglas Fir-Larch	#1	11-1	17-4	22-5	Note b	Note b	10-6	15-4	19-5	23-9	Note b
	Douglas Fir-Larch	#2	10-10	16-7	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	10-10	17-0	22-5	Note b	Note b	10-10	17-0	22-5	Note b	Note b
	Hem-Fir	#1	10 -7	16-8	21-10	Note b	Note b	10-3	14-11	18-11	23-2	Note b
	Hem-Fir	#2	10-1	15-11	20-8	25-3	Note b	9-8	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	11-3	17-8	23-4	Note b	Note b	11-3	17-8	23-4	Note b	Note b
12—continued	Southern Pine	#1	10-10	17-0	22-5	26-0	26-0	10-6	15-8	19-10	23-2	Note b
	Southern Pine	#2	10-4	15-7	19-8	23-5	26-0	9-0	13-6	17-1	20-3	23-10
	Southern Pine	#3	8-0	11-9	14-10	18-0	21-4	6-11	10-2	12-10	15-7	18-6
	Spruce-Pine-Fir	SS	10-7	16-8	21-11	Note b	Note b	10-7	16-8	21-9	Note b	Note b
	Spruce-Pine-Fir	#1	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6

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TABLE 2308.11.2(1)—RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)—continued

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
16	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-0	20-3	24-9	Note b
	Douglas Fir-Larch	#1	10-0	15-4	19-5	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	9-10	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	19-11	24-4	Note b
	Hem-Fir	#1	9-8	14-11	18-11	23-2	Note b	8-10	12-11	16-5	20-0	23-3
	Hem-Fir	#2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	25-7	Note b
	Southern Pine	#1	9-10	15-6	19-10	23-2	26-0	9-1	13-7	17-2	20-1	23-10
	Southern Pine	#2	9-0	13-6	17-1	20-3	23-10	7-9	11-8	14-9	17-6	20-8
	Southern Pine	#3	6-11	10-2	12-10	15-7	18-6	6-0	8-10	11-2	13-6	16-0
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	14-10	18-10	23-0	Note b
	Spruce-Pine-Fir	#1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

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**TABLE 2308.11.2(1)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)—continued**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	9-10	15-5	20-4	25-11	Note b	9-10	14-7	18-6	22-7	Note b
	Douglas Fir-Larch	#1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-11	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-4	18-2	22-3	25-9
	Hem-Fir	#1	9-1	13-8	17-4	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-7	23-4	Note b
	Southern Pine	#1	9-3	14-3	18-1	21-2	25-2	8-4	12-4	15-8	18-4	21-9
	Southern Pine	#2	8-2	12-3	15-7	18-6	21-9	7-1	10-8	13-6	16-0	18-10
	Southern Pine	#3	6-4	9-4	11-9	14-3	16-10	5-6	8-1	10-2	12-4	14-7
	Spruce-Pine-Fir	SS	9-1	14-3	18-9	23-11	Note b	9-1	13-7	17-2	21-0	24-4
	Spruce-Pine-Fir	#1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas Fir-Larch	SS	9-1	14-4	18-10	23-4	Note b	8-11	13-1	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	12-10	16-3	19-10	23-0
	Hem-Fir	#1	8-4	12-3	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	13-10	17-6	20-10	24-8
	Southern Pine	#1	8-7	12-9	16-2	18-11	22-6	7-5	11-1	14-0	16-5	19-6
	Southern Pine	#2	7-4	11-0	13-11	16-6	19-6	6-4	9-6	12-1	14-4	16-10
	Southern Pine	#3	5-8	8-4	10-6	12-9	15-1	4-11	7-3	9-1	11-0	13-1

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**TABLE 2308.11.2(1)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)—continued**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
24—continued	Spruce-Pine-Fir	SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.11.2(7).

b. Span exceeds 26 feet in length.

**TABLE 2308.11.2(2)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling attached to rafters, L/Δ = 240)**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-4	21-7	Note b	Note b
	Douglas Fir-Larch	#1	10-0	15-9	20-10	Note b	Note b	10-0	15-4	19-5	23-9	Note b
	Douglas Fir-Larch	#2	9-10	15-6	20-5	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	Note b	Note b
	Hem-Fir	#1	9-8	15-2	19-11	25-5	Note b	9-8	14-11	18-11	23-2	Note b
	Hem-Fir	#2	9-2	14-5	19-0	24-3	Note b	9-2	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern Pine	#1	9-10	15-6	20-5	26-0	26-0	9-10	15-6	19-10	23-2	26-0
	Southern Pine	#2	9-5	14-9	19-6	23-5	26-0	9-0	13-6	17-1	20-3	23-10
	Southern Pine	#3	8-0	11-9	14-10	18-0	21-4	6-11	10-2	12-10	15-7	18-6
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Spruce-Pine-Fir	#1	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6

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TABLE 2308.11.2(2)—RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling attached to rafters, L/Δ = 240)—continued

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0	Note b	9-6	14-11	19-7	24-9	Note b
	Douglas Fir-Larch	#1	9-1	14-4	18-11	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	8-11	14-1	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Hem-Fir	#1	8-9	13-9	18-1	23-1	Note b	8-9	12-11	16-5	20-0	23-3
	Hem-Fir	#2	8-4	13-1	17-3	21-11	25-5	8-4	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	9-4	14-7	19-3	24-7	Note b	9-4	14-7	19-3	24-7	Note b
	Southern Pine	#1	8-11	14-1	18-6	23-2	26-0	8-11	13-7	17-2	20-1	23-10
	Southern Pine	#2	8-7	13-5	17-1	20-3	23-10	7-9	11-8	14-9	17-6	20-8
	Southern Pine	#3	6-11	10-2	12-10	15-7	18-6	6-0	8-10	11-2	13-6	16-0
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1	Note b	8-9	13-9	18-1	23-0	Note b
	Spruce-Pine-Fir	#1	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-7	Note b	8-11	14-0	18-5	22-7	Note b
	Douglas Fir-Larch	#1	8-7	13-6	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-5	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	25-9
	Hem-Fir	#1	8-3	12-11	17-1	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	7-10	12-4	16-3	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	8-9	13-9	18-2	23-1	Note b	8-9	13-9	18-2	23-1	Note b
	Southern Pine	#1	8-5	13-3	17-5	21-2	25-2	8-4	12-4	15-8	18-4	21-9
	Southern Pine	#2	8-1	12-3	15-7	18-6	21-9	7-1	10-8	13-6	16-0	18-10
	Southern Pine	#3	6-4	9-4	11-9	14-3	16-10	5-6	8-1	10-2	12-4	14-7

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TABLE 2308.11.2(2)—RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling attached to rafters, L/Δ = 240)—continued

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2—continued	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-9	Note b	8-3	12-11	17-1	21-0	24-4
	Spruce-Pine-Fir	#1	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas Fir-Larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-0	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	7-10	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-10	23-0
	Hem-Fir	#1	7-8	12-0	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-3	11-5	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	20-10	24-8
	Southern Pine	#1	7-10	12-3	16-2	18-11	22-6	7-5	11-1	14-0	16-5	19-6
	Southern Pine	#2	7-4	11-0	13-11	16-6	19-6	6-4	9-6	12-1	14-4	16-10
	Southern Pine	#3	5-8	8-4	10-6	12-9	15-1	4-11	7-3	9-1	11-0	13-1
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.11.2(7).

b. Span exceeds 26 feet in length.

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TABLE 2308.11.2(3)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$= 30 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-0	15-9	20-9	Note b	Note b	10-0	15-9	20-1	24-6	Note b
	Douglas Fir-Larch	#1	9-8	14-9	18-8	22-9	Note b	9-0	13-2	16-8	20-4	23-7
	Douglas Fir-Larch	#2	9-5	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas Fir-Larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	SS	9-6	14-10	19-7	25-0	Note b	9-6	14-10	19-7	24-1	Note b
	Hem-Fir	#1	9-3	14-4	18-2	22-2	25-9	8-9	12-10	16-3	19-10	23-0
	Hem-Fir	#2	8-10	13-7	17-2	21-0	24-4	8-4	12-2	15-4	18-9	21-9
	Hem-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern Pine	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	25-4	Note b
	Southern Pine	#1	9-6	14-10	19-0	22-3	26-0	9-0	13-5	17-0	19-11	23-7
	Southern Pine	#2	8-7	12-11	16-4	19-5	22-10	7-8	11-7	14-8	17-4	20-5
	Southern Pine	#3	6-7	9-9	12-4	15-0	17-9	5-11	8-9	11-0	13-5	15-10
	Spruce-Pine-Fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-7	18-8	22-9	Note b
	Spruce-Pine-Fir	#1	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#2	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas Fir-Larch	SS	9-1	14-4	18-10	23-9	Note b	9-1	13-9	17-5	21-3	24-8
	Douglas Fir-Larch	#1	8-9	12-9	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas Fir-Larch	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas Fir-Larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-Fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-1	20-10	24-2
	Hem-Fir	#1	8-5	12-5	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-Fir	#2	8-0	11-9	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern Pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-5	21-11	25-11
	Southern Pine	#1	8-7	13-0	16-6	19-3	22-10	7-10	11-7	14-9	17-3	20-5
	Southern Pine	#2	7-6	11-2	14-2	16-10	19-10	6-8	10-0	12-8	15-1	17-9
	Southern Pine	#3	5-9	8-6	10-8	13-0	15-4	5-2	7-7	9-7	11-7	13-9

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**TABLE 2308.11.2(3)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$= 30 psf, ceiling not attached to rafters, L/Δ = 180)—continued**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
16—continued	Spruce-Pine-Fir	SS	8-5	13-3	17-5	22-1	25-7	8-5	12-9	16-2	19-9	22-10
	Spruce-Pine-Fir	#1	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
19.2	Douglas Fir-Larch	SS	8-7	13-6	17-9	21-8	25-2	8-7	12-6	15-10	19-5	22-6
	Douglas Fir-Larch	#1	7-11	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas Fir-Larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-Fir	SS	8-1	12-9	16-9	21-4	24-8	8-1	12-4	15-7	19-1	22-1
	Hem-Fir	#1	7-9	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-Fir	#2	7-4	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern Pine	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	16-10	20-0	23-7
	Southern Pine	#1	8-0	11-10	15-1	17-7	20-11	7-1	10-7	13-5	15-9	18-8
	Southern Pine	#2	6-10	10-2	12-11	15-4	18-1	6-1	9-2	11-7	13-9	16-2
	Southern Pine	#3	5-3	7-9	9-9	11-10	14-0	4-8	6-11	8-9	10-7	12-6
	Spruce-Pine-Fir	SS	7-11	12-5	16-5	20-2	23-4	7-11	11-8	14-9	18-0	20-11
	Spruce-Pine-Fir	#1	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
24	Douglas Fir-Larch	SS	7-11	12-6	15-10	19-5	22-6	7-8	11-3	14-2	17-4	20-1
	Douglas Fir-Larch	#1	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-Fir	SS	7-6	11-10	15-7	19-1	22-1	7-6	11-0	13-11	17-0	19-9
	Hem-Fir	#1	6-11	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-Fir	#2	6-7	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

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TABLE 2308.11.2(3)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$= 30 psf, ceiling not attached to rafters, L/Δ = 180)—continued

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
24—continued	Southern Pine	SS	7-10	12-3	16-2	20-0	23-7	7-10	11-10	15-0	17-11	21-2
	Southern Pine	#1	7-1	10-7	13-5	15-9	18-8	6-4	9-6	12-0	14-1	16-8
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-5	8-2	10-4	12-3	14-6
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-2	6-2	7-10	9-6	11-2
	Spruce-Pine-Fir	SS	7-4	11-7	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#1	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.11.2(7).

b. Span exceeds 26 feet in length.

TABLE 2308.11.2(4)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$ = 50 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	8-5	13-3	17-6	22-4	26-0	8-5	13-3	17-0	20-9	24-0
	Douglas Fir-larch	#1	8-2	12-0	15-3	18-7	21-7	7-7	11-2	14-1	17-3	20-0
	Douglas Fir-larch	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-Fir	SS	8-0	12-6	16-6	21-1	25-6	8-0	12-6	16-6	20-4	23-7
	Hem-Fir	#1	7-10	11-9	14-10	18-1	21-0	7-5	10-10	13-9	16-9	19-5
	Hem-Fir	#2	7-5	11-1	14-0	17-2	19-11	7-0	10-3	13-0	15-10	18-5
	Hem-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern Pine	SS	8-4	13-1	17-2	21-11	Note b	8-4	13-1	17-2	21-5	25-3
	Southern Pine	#1	8-0	12-3	15-6	18-2	21-7	7-7	11-4	14-5	16-10	20-0
	Southern Pine	#2	7-0	10-6	13-4	15-10	18-8	6-6	9-9	12-4	14-8	17-3
	Southern Pine	#3	5-5	8-0	10-1	12-3	14-6	5-0	7-5	9-4	11-4	13-5

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**TABLE 2308.11.2(4)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$ = 50 psf, ceiling not attached to rafters, L/Δ = 180)—continued**

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12—continued	Spruce-Pine-Fir	SS	7-10	12-3	16-2	20-8	24-1	7-10	12-3	15-9	19-3	22-4
	Spruce-Pine-Fir	#1	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas Fir-Larch	SS	7-8	12-1	15-10	19-5	22-6	7-8	11-7	14-8	17-11	20-10
	Douglas Fir-Larch	#1	7-1	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-Fir	SS	7-3	11-5	15-0	19-1	22-1	7-3	11-5	14-5	17-8	20-5
	Hem-Fir	#1	6-11	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	#2	6-7	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern Pine	SS	7-6	11-10	15-7	19-11	23-7	7-6	11-10	15-7	18-6	21-10
	Southern Pine	#1	7-1	10-7	13-5	15-9	18-8	6-7	9-10	12-5	14-7	17-3
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-8	8-5	10-9	12-9	15-0
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-4	6-5	8-1	9-10	11-7
	Spruce-Pine-Fir	SS	7-1	11-2	14-8	18-0	20-11	7-1	10-9	13-8	15-11	19-4
	Spruce-Pine-Fir	#1	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
19.2	Douglas Fir-Larch	SS	7-3	11-4	14-6	17-8	20-6	7-3	10-7	13-5	16-5	19-0
	Douglas Fir-Larch	#1	6-6	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas Fir-Larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas Fir-Larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-Fir	SS	6-10	10-9	14-2	17-5	20-2	6-10	10-5	13-2	16-1	18-8
	Hem-Fir	#1	6-4	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#2	6-0	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2

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TABLE 2308.11.2(4)—RAFTER SPANS FOR COMMON LUMBER SPECIES (Allowable stress design ground snow load, $p_{g(asd)}$ = 50 psf, ceiling not attached to rafters, L/Δ = 180)—continued

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2—continued	Southern Pine	SS	7-1	11-2	14-8	18-3	21-7	7-1	11-2	14-2	16-11	20-0
	Southern Pine	#1	6-6	9-8	12-3	14-4	17-1	6-0	9-0	11-4	13-4	15-9
	Southern Pine	#2	5-7	8-4	10-7	12-6	14-9	5-2	7-9	9-9	11-7	13-8
	Southern Pine	#3	4-3	6-4	8-0	9-8	11-5	4-0	5-10	7-4	8-11	10-7
	Spruce-Pine-Fir	SS	6-8	10-6	13-5	16-5	19-1	6-8	9-10	12-5	15-3	17-8
	Spruce-Pine-Fir	#1	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
24	Douglas Fir-Larch	SS	6-8	10-3	13-0	15-10	18-4	6-6	9-6	12-0	14-8	17-0
	Douglas Fir-Larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas Fir-Larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas Fir-Larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-Fir	SS	6-4	9-11	12-9	15-7	18-0	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern Pine	SS	6-7	10-4	13-8	16-4	19-3	6-7	10-0	12-8	15-2	17-10
	Southern Pine	#1	5-10	8-8	11-0	12-10	15-3	5-5	8-0	10-2	11-11	14-1
	Southern Pine	#2	5-0	7-5	9-5	11-3	13-2	4-7	6-11	8-9	10-5	12-3
	Southern Pine	#3	3-10	5-8	7-1	8-8	10-3	3-6	5-3	6-7	8-0	9-6
	Spruce-Pine-Fir	SS	6-2	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Spruce-Pine-Fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.11.2(7).

b. Span exceeds 26 feet in length.

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TABLE 2308.11.2(5)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$ = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	9-1	14-4	18-10	24-1	Note b	9-1	14-4	18-10	24-1	Note b
	Douglas Fir-Larch	#1	8-9	13-9	18-2	22-9	Note b	8-9	13-2	16-8	20-4	23-7
	Douglas Fir-Larch	#2	8-7	13-6	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas Fir-Larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-10	22-9	Note b
	Hem-Fir	#1	8-5	13-3	17-5	22-2	25-9	8-5	12-10	16-3	19-10	23-0
	Hem-Fir	#2	8-0	12-7	16-7	21-0	24-4	8-0	12-2	15-4	18-9	21-9
	Hem-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern Pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Southern Pine	#1	8-7	13-6	17-10	22-3	Note b	8-7	13-5	17-0	19-11	23-7
	Southern Pine	#2	8-3	12-11	16-4	19-5	22-10	7-8	11-7	14-8	17-4	20-5
	Southern Pine	#3	6-7	9-9	12-4	15-0	17-9	5-11	8-9	11-0	13-5	15-10
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	Note b
	Spruce-Pine-Fir	#1	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#2	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas Fir-Larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	17-2	21-3	24-8
	Douglas Fir-Larch	#1	8-0	12-6	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas Fir-Larch	#2	7-10	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas Fir-Larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-Fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	20-8	24-2
	Hem-Fir	#1	7-8	12-0	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-Fir	#2	7-3	11-5	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern Pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	21-6	25-11
	Southern Pine	#1	7-10	12-3	16-2	19-3	22-10	7-10	11-7	14-9	17-3	20-5
	Southern Pine	#2	7-6	11-2	14-2	16-10	19-10	6-8	10-0	12-8	15-1	17-9
	Southern Pine	#3	5-9	8-6	10-8	13-0	15-4	5-2	7-7	9-7	11-7	13-9

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TABLE 2308.11.2(5)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$ = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
16—continued	Spruce-Pine-Fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	19-9	22-10
	Spruce-Pine-Fir	#1	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#2	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
19.2	Douglas Fir-Larch	SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	15-10	19-5	22-6
	Douglas Fir-Larch	#1	7-6	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#2	7-4	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas Fir-Larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-Fir	SS	7-4	11-7	15-3	19-5	23-7	7-4	11-7	15-3	19-1	22-1
	Hem-Fir	#1	7-2	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-Fir	#2	6-10	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern Pine	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	20-0	23-7
	Southern Pine	#1	7-4	11-7	15-1	17-7	20-11	7-1	10-7	13-5	15-9	18-8
	Southern Pine	#2	6-10	10-2	12-11	15-4	18-1	6-1	9-2	11-7	13-9	16-2
	Southern Pine	#3	5-3	7-9	9-9	11-10	14-0	4-8	6-11	8-9	10-7	12-6
	Spruce-Pine-Fir	SS	7-2	11-4	14-11	19-0	23-1	7-2	11-4	14-9	18-0	20-11
	Spruce-Pine-Fir	#1	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#2	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
24	Douglas Fir-Larch	SS	7-3	11-4	15-0	19-1	22-6	7-3	11-3	14-2	17-4	20-1
	Douglas Fir-Larch	#1	7-0	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-Fir	SS	6-10	10-9	14-2	18-0	21-11	6-10	10-9	13-11	17-0	19-9
	Hem-Fir	#1	6-8	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-Fir	#2	6-4	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

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TABLE 2308.11.2(5)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$ = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
24—continued	Southern Pine	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	17-11	21-2
	Southern Pine	#1	6-10	10-7	13-5	15-9	18-8	6-4	9-6	12-0	14-1	16-8
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-5	8-2	10-4	12-3	14-6
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-2	6-2	7-10	9-6	11-2
	Spruce-Pine-Fir	SS	6-8	10-6	13-10	17-8	20-11	6-8	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#1	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#2	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.11.2(7).

b. Span exceeds 26 feet in length.

TABLE 2308.11.2(6)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$ = 50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	7-8	12-1	15-11	20-3	24-8	7-8	12-1	15-11	20-3	24-0
	Douglas Fir-Larch	#1	7-5	11-7	15-3	18-7	21-7	7-5	11-2	14-1	17-3	20-0
	Douglas Fir-Larch	#2	7-3	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-Fir	SS	7-3	11-5	15-0	19-2	23-4	7-3	11-5	15-0	19-2	23-4
	Hem-Fir	#1	7-1	11-2	14-8	18-1	21-0	7-1	10-10	13-9	16-9	19-5
	Hem-Fir	#2	6-9	10-8	14-0	17-2	19-11	6-9	10-3	13-0	15-10	18-5
	Hem-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern Pine	SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	24-3
	Southern Pine	#1	7-3	11-5	15-0	18-2	21-7	7-3	11-4	14-5	16-10	20-0
	Southern Pine	#2	6-11	10-6	13-4	15-10	18-8	6-6	9-9	12-4	14-8	17-3
	Southern Pine	#3	5-5	8-0	10-1	12-3	14-6	5-0	7-5	9-4	11-4	13-5

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TABLE 2308.11.2(6)—RAFTER SPANS FOR COMMON LUMBER SPECIES
(Allowable stress design ground snow load, $p_{g(asd)}$ = 50 psf, ceiling attached to rafters, L/Δ = 240)—continued

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12—continued	Spruce-Pine-Fir	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-4
	Spruce-Pine-Fir	#1	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#2	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas Fir-Larch	SS	7-0	11-0	14-5	18-5	22-5	7-0	11-0	14-5	17-11	20-10
	Douglas Fir-Larch	#1	6-9	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas Fir-Larch	#2	6-7	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-Fir	SS	6-7	10-4	13-8	17-5	21-2	6-7	10-4	13-8	17-5	20-5
	Hem-Fir	#1	6-5	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	#2	6-2	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern Pine	SS	6-10	10-9	14-2	18-1	22-0	6-10	10-9	14-2	18-1	21-10
	Southern Pine	#1	6-7	10-4	13-5	15-9	18-8	6-7	9-10	12-5	14-7	17-3
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-8	8-5	10-9	12-9	15-0
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-4	6-5	8-1	9-10	11-7
	Spruce-Pine-Fir	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-8	19-4
	Spruce-Pine-Fir	#1	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#2	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
19.2	Douglas Fir-Larch	SS	6-7	10-4	13-7	17-4	20-6	6-7	10-4	13-5	16-5	19-0
	Douglas Fir-Larch	#1	6-4	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas Fir-Larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas Fir-Larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-Fir	SS	6-2	9-9	12-10	16-5	19-11	6-2	9-9	12-10	16-1	18-8
	Hem-Fir	#1	6-1	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#2	5-9	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2

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TABLE 2308.11.2(6)—RAFTER SPANS FOR COMMON LUMBER SPECIES (Allowable stress design ground snow load, $p_{g(asd)}$ = 50 psf, ceiling attached to rafters, L/Δ = 240)—continued

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2—continued	Southern Pine	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-11	20-0
	Southern Pine	#1	6-2	9-8	12-3	14-4	17-1	6-0	9-0	11-4	13-4	15-9
	Southern Pine	#2	5-7	8-4	10-7	12-6	14-9	5-2	7-9	9-9	11-7	13-8
	Southern Pine	#3	4-3	6-4	8-0	9-8	11-5	4-0	5-10	7-4	8-11	10-7
	Spruce-Pine-Fir	SS	6-1	9-6	12-7	16-0	19-1	6-1	9-6	12-5	15-3	17-8
	Spruce-Pine-Fir	#1	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#2	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
24	Douglas Fir-Larch	SS	6-1	9-7	12-7	15-10	18-4	6-1	9-6	12-0	14-8	17-0
	Douglas Fir-Larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas Fir-Larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas Fir-Larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-Fir	SS	5-9	9-1	11-11	15-2	18-0	5-9	9-1	11-9	14-5	15-11
	Hem-Fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern Pine	SS	6-0	9-5	12-5	15-10	19-3	6-0	9-5	12-5	15-2	17-10
	Southern Pine	#1	5-9	8-8	11-0	12-10	15-3	5-5	8-0	10-2	11-11	14-1
	Southern Pine	#2	5-0	7-5	9-5	11-3	13-2	4-7	6-11	8-9	10-5	12-3
	Southern Pine	#3	3-10	5-8	7-1	8-8	10-3	3-6	5-3	6-7	8-0	9-6
	Spruce-Pine-Fir	SS	5-8	8-10	11-8	14-8	17-1	5-8	8-10	11-2	13-7	15-9
	Spruce-Pine-Fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.11.2(7).

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TABLE 2308.11.2(7)—RAFTER SPAN ADJUSTMENT FACTOR	
H_C/H_R[a]	RAFTER SPAN ADJUSTMENT FACTOR
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

a. H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls; H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

2308.11.3 Ceiling joist and rafter framing. Rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board not less than 1-inch (25 mm) nominal thickness at ridges and not less in depth than the cut end of the rafter. At valleys and hips, there shall be a single valley or hip rafter not less than 2-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter.

2308.11.3.1 Ceiling joist and rafter connections. Ceiling joists and rafters shall be nailed to each other and the assembly shall be nailed to the top wall plate in accordance with Tables 2304.10.2 and 2308.11.4. Ceiling joists shall be continuous or securely joined where they meet over interior partitions and be fastened to adjacent rafters in accordance with Tables 2304.10.2 and 2308.11.3.1 to provide a continuous rafter tie across the building where such joists are parallel to the rafters. Ceiling joists shall have a bearing surface of not less than $1^1/_2$ inches (38 mm) on the top plate at each end.

Where ceiling joists are not parallel to rafters, an equivalent rafter tie shall be installed in a manner to provide a continuous tie across the building, at a spacing of not more than 4 feet (1219 mm) on center. The connections shall be in accordance with Tables 2308.11.3.1 and 2304.10.2, or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top of the rafter support walls, the ridge formed by these rafters shall be supported by a girder conforming to Sections 2308.3 and 2308.4. Rafter ties shall be spaced not more than 4 feet (1219 mm) on center.

Rafter tie connections shall be based on the equivalent rafter spacing in Table 2308.11.3.1. Rafter-to-ceiling joist connections and rafter tie connections shall be of sufficient size and number to prevent splitting from nailing.

Roof framing member connection to braced wall lines shall be in accordance with Section 2308.10.7.2.

TABLE 2308.11.3.1—RAFTER TIE CONNECTIONS[i]

RAFTER SLOPE	TIE SPACING (inches)	LIVE LOAD ONLY[g]			ALLOWABLE STRESS DESIGN GROUND SNOW LOAD, $p_{g(asd)}$ (pounds per square foot)					
					30 pounds per square foot			50 pounds per square foot		
		Roof span (feet)								
		12	24	36	12	24	36	12	24	36
		Required number of 16d common ($3^1/_2$″ x 0.162″) nails per connection[a, b, c, d, e, f, h]								
3:12	12	3	5	8	3	6	9	5	9	13
	16	4	7	10	4	8	12	6	12	17
	19.2	4	8	12	5	10	14	7	14	21
	24	**5**	10	15	6	12	18	9	17	26
	32	7	13	20	8	16	24	12	23	34
	48	10	20	29	12	24	35	17	34	51
4:12	12	3	4	6	3	5	7	4	7	10
	16	3	5	8	3	6	9	5	9	13
	19.2	3	6	9	4	7	11	6	11	16
	24	4	8	11	5	9	13	7	13	19
	32	5	10	15	6	12	18	9	17	26
	48	8	15	22	9	18	26	13	26	38
5:12	12	3	3	5	3	4	6	3	6	8
	16	3	4	6	3	5	7	4	7	11
	19.2	3	5	7	3	6	9	5	9	13
	24	3	6	9	4	7	11	6	11	16

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TABLE 2308.11.3.1—RAFTER TIE CONNECTIONS[i]—continued

RAFTER SLOPE	TIE SPACING (inches)	LIVE LOAD ONLY[g]			ALLOWABLE STRESS DESIGN GROUND SNOW LOAD, $p_{g(asd)}$ (pounds per square foot)					
					30 pounds per square foot			50 pounds per square foot		
		Roof span (feet)								
		12	24	36	12	24	36	12	24	36
		Required number of 16d common ($3^1/_2$″ x 0.162″) nails per connection[a, b, c, d, e, f, h]								
5:12—continued	32	4	8	12	5	10	14	7	14	21
	48	6	12	18	7	14	21	11	21	31
7:12	12	3	3	4	3	3	4	3	4	6
	16	3	3	5	3	4	5	3	5	8
	19.2	3	4	5	3	4	6	3	6	9
	24	3	5	7	3	5	8	4	8	11
	32	3	6	9	4	7	10	5	10	15
	48	5	9	13	5	10	15	8	15	22
9:12	12	3	3	3	3	3	3	3	3	5
	16	3	3	4	3	3	4	3	4	6
	19.2	3	3	4	3	4	5	3	5	7
	24	3	4	5	3	4	6	3	6	9
	32	3	5	7	3	6	8	4	8	12
	48	4	7	10	4	8	12	6	12	17
12:12	12	3	3	3	3	3	3	3	3	4
	16	3	3	3	3	3	3	3	3	5
	19.2	3	3	3	3	3	4	3	4	6
	24	3	3	4	3	3	5	3	5	7
	32	3	4	5	3	4	6	3	6	9
	48	3	5	8	3	6	9	5	9	13

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m^2.

a. 10d common (3″ × 0.148″) nails shall be permitted to be substituted for 16d common ($3^1/_2$″ × 0.162″) nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.

b. Rafter tie heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements are permitted to be reduced proportionally to the reduction in span.

d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

e. Connected members shall be of sufficient size to prevent splitting due to nailing.

f. For allowable stress design snow loads less than 30 pounds per square foot, the required number of nails is permitted to be reduced by multiplying by the ratio of actual snow load plus 10 divided by 40, but not less than the number required for no snow load.

g. Applies to roof live load of 20 psf or less.

h. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the adjustment factors in Table 2308.11.3.1(1).

i. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

TABLE 2308.11.3.1(1)—HEEL JOINT CONNECTION ADJUSTMENT FACTORS

H_C/H_R[a, b]	HEEL JOINT CONNECTION ADJUSTMENT FACTOR
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

a. H_C = Height of ceiling joists or rafter ties measured vertically from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties; H_R = Height of roof ridge measured vertically from the top of the rafter support walls to the bottom of the roof ridge.

b. Where H_C/H_R exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.

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2308.11.4 Wind uplift. The roof construction shall have rafter and truss ties to the wall below. Resultant uplift loads shall be transferred to the foundation using a continuous load path. The rafter or truss to wall connection shall comply with Tables 2304.10.2 and 2308.11.4.

Exception: The truss to wall connection shall be determined from the uplift forces as specified on the truss design drawings or as shown on the construction documents.

TABLE 2308.11.4—REQUIRED RATING OF APPROVED UPLIFT CONNECTORS (pounds)[a, b, c, e, f, g, h, d]

BASIC WINDSPEED, *V*[i], (mph)	ROOF SPAN (feet)						
	12	20	24	28	32	36	40
EXPOSURE B							
90	-64	-85	-96	-107	-117	-128	-139
100	-102	-139	-158	-177	-195	-214	-233
110	-144	-199	-226	-254	-282	-310	-338
120	-190	-265	-302	-339	-377	-414	-452
130	-240	-335	-382	-431	-479	-528	-576
140	-294	-411	-470	-530	-590	-650	-710
EXPOSURE C							
90	-126	-175	-199	-223	-247	-272	-296
100	-179	-250	-285	-320	-356	-391	-426
110	-238	-332	-380	-428	-476	-525	-573
120	-302	-424	-485	-547	-608	-669	-731
130	-371	-521	-597	-674	-751	-828	-904
140	-446	-628	-719	-812	-904	-997	-1090
EXPOSURE D							
90	-166	-232	-265	-298	-311	-364	-396
100	-229	-321	-367	-413	-459	-505	-551
110	-298	-418	-478	-539	-601	-662	-723
120	-373	-526	-603	-679	-756	-833	-910
130	-455	-641	-734	-829	-924	-1020	-1114
140	-544	-767	-878	-992	-1106	-1220	-1333

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.61 km/hr, 1 pound = 0.454 Kg, 1 pound/foot = 14.5939 N/m.

a. The uplift connection requirements are based on a 33-foot mean roof height.

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for 10 pounds of dead load.

d. The uplift connection requirements include for the effects of 24-inch overhangs.

e. The uplift connection requirements are based on wind loading on end zones as defined in Figure 28.3-1 of ASCE 7. Connection loads for connections located a distance of 20 percent of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.75.

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 500-pound rated connector is used on the roof framing, a 400-pound rated connector is permitted at the next floor level down).

g. Interpolation is permitted for intermediate values of *V* and roof spans.

h. The rated capacity of approved tie-down devices is permitted to include up to a 60-percent increase for wind effects where allowed by material specifications. The required rating of approved uplift connectors is based on allowable stress design loads.

i. *V* shall be determined in accordance with Section 1609.3.

2308.11.5 Framing around openings. Trimmer and header rafters shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header rafters that are more than 6 feet (1829 mm) in length shall be supported by framing anchors or rafter hangers unless bearing on a beam, partition or wall.

2308.11.5.1 Openings in roof diaphragms in Seismic Design Categories B, C, D and E. In buildings classified as Seismic Design Category B, C, D or E. openings in horizontal diaphragms with a dimension that is greater than 4 feet (1219 mm) shall be constructed with metal ties and blocking in accordance with this section and Figure 2308.8.4.1(1). Metal ties shall be not less than 0.058 inch [1.47 mm (16 galvanized gage)] in thickness by $1^1/_2$ inches (38 mm) in width and shall have a yield stress not less than 33,000 psi (227 MPa). Blocking shall extend not less than the dimension of the opening in the direction of the tie and blocking. Ties shall be attached to blocking in accordance with the manufacturer's instructions but with not less than eight 16d common nails on each side of the header-joist intersection.

2308.11.6 Purlins. Purlins to support roof loads are permitted to be installed to reduce the span of rafters within allowable limits and shall be supported by struts to bearing walls. The maximum span of 2-inch by 4-inch (51 mm by 102 mm) purlins shall be 4 feet (1219 mm). The maximum span of the 2-inch by 6-inch (51 mm by 152 mm) purlin shall be 6 feet (1829 mm), but the purlin shall not be smaller than the supported rafter. Struts shall be not less than 2-inch by 4-inch (51 mm by 102 mm) members. The

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unbraced length of struts shall not exceed 8 feet (2438 mm) and the slope of the struts shall be not less than 45 degrees (0.79 rad) from the horizontal.

2308.11.7 Blocking. Roof rafters and ceiling joists shall be supported laterally to prevent rotation and lateral displacement in accordance with Section 2308.8.6 and connected to braced wall lines in accordance with Section 2308.10.7.2.

2308.11.8 Engineered wood products. Prefabricated wood I-joists, structural glued-laminated timber and structural composite lumber shall not be notched or drilled except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

2308.11.9 Roof sheathing. Roof sheathing shall be in accordance with Tables 2304.8(3) and 2304.8(5) for wood structural panels, and Tables 2304.8(1) and 2304.8(2) for lumber and shall comply with Section 2304.8.2.

2308.11.10 Joints. Joints in lumber sheathing shall occur over supports unless approved end-matched lumber is used, in which case each piece shall bear on not fewer than two supports.

2308.11.11 Roof planking. Planking shall be designed in accordance with the general provisions of this code.

In lieu of such design, 2-inch (51 mm) tongue-and groove planking is permitted in accordance with Table 2308.11.11. Joints in such planking are permitted to be randomly spaced, provided that the system is applied to not less than three continuous spans, planks are center matched and end matched or splined, each plank bears on one support or more, and joints are separated by not less than 24 inches (610 mm) in adjacent pieces.

TABLE 2308.11.11—ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING

SPAN[a] (feet)	LIVE LOAD (pounds per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pounds per square inch)	MODULUS OF ELASTICITY (E) (pounds per square inch)
Roofs				
4	20	1/240 1/360	160	170,000 256,000
	30	1/240 1/360	210	256,000 384,000
	40	1/240 1/360	270	340,000 512,000
4.5	20	1/240 1/360	200	242,000 305,000
	30	1/240 1/360	270	363,000 405,000
	40	1/240 1/360	350	484,000 725,000
5.0	20	1/240 1/360	250	332,000 500,000
	30	1/240 1/360	330	495,000 742,000
	40	1/240 1/360	420	660,000 1,000,000
5.5	20	1/240 1/360	300	442,000 660,000
	30	1/240 1/360	400	662,000 998,000
	40	1/240 1/360	500	884,000 1,330,000
6.0	20	1/240 1/360	360	575,000 862,000
	30	1/240 1/360	480	862,000 1,295,000
	40	1/240 1/360	600	1,150,000 1,730,000

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TABLE 2308.11.11—ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING—continued				
SPAN[a] (feet)	LIVE LOAD (pounds per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pounds per square inch)	MODULUS OF ELASTICITY (E) (pounds per square inch)
6.5	20	1/240 1/360	420	595,000 892,000
	30	1/240 1/360	560	892,000 1,340,000
	40	1/240 1/360	700	1,190,000 1,730,000
7.0	20	1/240 1/360	490	910,000 1,360,000
	30	1/240 1/360	650	1,370,000 2,000,000
	40	1/240 1/360	810	1,820,000 2,725,000
7.5	20	1/240 1/360	560	1,125,000 1,685,000
	30	1/240 1/360	750	1,685,000 2,530,000
	40	1/240 1/360	930	2,250,000 3,380,000
8.0	20	1/240 1/360	640	1,360,000 2,040,000
	30	1/240 1/360	850	2,040,000 3,060,000
Floors				
4 4.5 5.0	40	1/360	840 950 1,060	1,000,000 1,300,000 1,600,000

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m^2, 1 pound per square inch = 0.00689 N/mm^2.

a. Spans are based on simple beam action with 10 pounds per square foot dead load and provisions for a 300-pound concentrated load on a 12-inch width of decking. Random layup is permitted in accordance with the provisions of Section 2308.11.11. Lumber thickness is $1^1/_2$ inches nominal.

2308.11.12 Wood trusses. Wood trusses shall be designed in accordance with Section 2303.4. Connection to braced wall lines shall be in accordance with Section 2308.10.7.2.

2308.11.13 Attic ventilation. For attic ventilation, see Section 1202.2.1.

SECTION 2309—WOOD FRAME CONSTRUCTION MANUAL

2309.1 Wood Frame Construction Manual. Structural design in accordance with the AWC WFCM shall be permitted for buildings assigned to Risk Category I or II subject to the limitations of Section 1.1.3 of the AWC WFCM and the load assumptions contained therein. Structural elements beyond these limitations shall be designed in accordance with accepted engineering practice.

2309.1.1 Additional requirements. [DSA-SS, DSA-SS/CC, OSHPD 1R, 2 & 5] *The use of the AWC WFCM is permitted provided the design and construction also comply with Sections 2304, 2305 and 2302.1, Item 1 or 2, and engineering analysis is furnished demonstrating compliance.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 24 – GLASS AND GLAZING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X		X	X	X								X			X								
Adopt entire chapter as amended (amended sections listed below)								X	X	X	X	X		X	X									
Adopt only those sections that are listed below																								
Chapter / Section																								
2401.1.1								X	X	X	X	X		X	X									
2401.1.2								X	X	X	X	X		X	X									
2403.2.1								X	X	X	X	X		X	X									
Table 2403.2.1								X	X	X	X	X		X	X									
2410								X	X	X	X	X		X	X									
2410.1, Exception												X												
2410.1.2, Exception								X	X															
2411										X	X	X		X	X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

24 GLASS AND GLAZING

User notes:

About this chapter: Chapter 24 establishes regulations for glass and glazing used in buildings and structures. Engineering and design requirements are included in the chapter for glazing that is subjected to wind and snow loads. Another concern of this chapter is glass and glazing used in areas where it is likely to be impacted by the occupants. Section 2406 identifies hazardous locations where glazing must either be safety glazing or protected to prevent impacts by occupants. Safety glazing must meet stringent standards and be appropriately marked or identified. Additional requirements are provided for glass and glazing in guards, handrails, elevator hoistways and elevator cars, as well as in athletic facilities.

ICC code development note: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 2401—GENERAL

2401.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of glass, light-transmitting ceramic and light-transmitting plastic panels for exterior and interior use in both vertical and sloped applications in buildings and structures. Light-transmitting plastic glazing shall also meet the applicable requirements of Chapter 26.

2401.1.1 Application. [DSA-SS, DSA-SS/CC, OSHPD] *The scope of application of Chapter 24 is as follows:*

1. *Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.*
2. *Applications listed in Sections 1.9.2.1 and 1.9.2.2, regulated by the Division of the State Architect-Structural Safety (DSA-SS and DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*

2401.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC, OSHPD] *DSA-SS, DSA-SS/CC, OSHPD adopt this chapter as amended.* <

1. *OSHPD amendments appear in this chapter preceded with the appropriate acronym, as follows:*

   [OSHPD 1] *- For applications listed in Section 1.10.1.*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 4] *- For applications listed in Section 1.10.4.*

   [OSHPD 5] *- For applications listed in Section 1.10.5.*
2. *Division of the State Architect - Structural Safety amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS] *- For applications listed in Section 1.9.2.1.*

   [DSA-SS/CC] *- For applications listed in Section 1.9.2.2.*

SECTION 2402—GLAZING REPLACEMENT

2402.1 General. The installation of replacement glass shall be as required for new installations.

SECTION 2403—GENERAL REQUIREMENTS FOR GLASS

2403.1 Identification. Each pane shall bear the manufacturer's mark designating the type and thickness of the glass or glazing material. The identification shall not be omitted unless approved and an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved construction documents that comply with the provisions of this chapter. Safety glazing shall be identified in accordance with Section 2406.3.

Each pane of tempered glass, except tempered spandrel glass, shall be permanently identified by the manufacturer. The identification mark shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

Tempered spandrel glass shall be provided with a removable paper marking by the manufacturer.

2403.2 Glass supports. Where one or more sides of any pane of glass are not firmly supported, or are subjected to unusual load conditions, detailed construction documents, detailed shop drawings and analysis or test data ensuring safe performance for the specific installation shall be prepared by a registered design professional.

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2403.2.1 Additional Requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *In addition to the requirements of Section 2403.2, glass supports shall comply with the following:*

1. *The construction documents and analysis or test data required per Section 2403.2 shall be submitted to the enforcement agency for approval.*
2. *Glass firmly supported on all four edges shall be glazed with minimum laps and edge clearances set forth in Table 2403.2.1.*

   Exception: *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

TABLE 2403.2.1—MINIMUM GLAZING REQUIREMENTS

FIXED WINDOWS AND OPENABLE WINDOWS OTHER THAN HORIZONTAL SIDING					
Glass Area	***Up to 6 sq. ft.***	***6 to 14 sq. ft.***	***14 to 32 sq. ft.***	***32 to 50 sq. ft.***	***Over 50 sq. ft.***
× 0.0929 for m², × 25.4 for mm					
1. Minimum Frame Lap	$^1/_4$"	$^1/_4$"	$^5/_{16}$"	$^3/_8$"	$^1/_2$"
2. Minimum Glass Edge Clearance	$^1/_8$"[1,2]	$^1/_8$"[1,2]	$^3/_{16}$"[1]	$^1/_4$"	$^1/_4$"[1]
3. Continuous Glazing Rabbet and Glass Retainer[3]	*Required*				
4. Resilient Setting Material[4]	*Not Required*	*Required*			
SLIDING DOORS AND HORIZONTAL SLIDING WINDOWS					
Glass Area		***Up to 14 sq. ft.***	***14 to 32 sq. ft.***	***32 to 50 sq. ft.***	***Over 50 sq. ft.***
× 0.0929 for m², × 25.4 for mm					
5. Minimum Glass Frame Lap		$^1/_4$"	$^5/_{16}$"	$^3/_8$"	$^1/_2$"
6. Minimum Glass Edge Clearance		$^1/_8$"[2]	$^3/_{16}$"	$^1/_4$"	$^1/_4$"
7. Continuous Glazing Rabbet and Glass Retainer[3]		*Required above third story*	*Required*		
8. Resilient Setting Material[4]		*Not Required*		*Required*	

1. *Glass edge clearance in fixed openings shall not be less than required to provide for wind and earthquake drift.*
2. *Glass edge clearance at all sides of pane shall be a minimum of $^3/_{16}$ inch (4.8 mm) where height of glass exceeds 3 feet (914 mm).*
3. *Glass retainers such as metal, wood or vinyl face stops, glazing beads, gaskets, glazing clips and glazing channels shall be of sufficient strength and fixation to serve this purpose.*
4. *Resilient setting material shall include preformed rubber or vinyl plastic gaskets or other materials which are proved to the satisfaction of the building official to remain resilient.*

2403.3 Glass framing. To be considered firmly supported, the framing members for each individual pane of glass shall be designed so that the deflection of the edge of the glass perpendicular to the glass pane does not exceed $^1/_{175}$ of the glass edge length where the glass edge length is not more than 13 feet 6 inches (4115 mm), or $^1/_{240}$ of the glass edge length + $^1/_4$ inch (6.4 mm) where the glass edge length is greater than 13 feet 6 inches (4115 mm), when subjected to the larger of the positive or negative load where loads are combined as specified in Section 1605.

2403.4 Interior glazed areas. Where interior glazing is installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges shall be not greater than the thickness of the panels when a force of 50 pounds per linear foot (plf) (730 N/m) is applied horizontally to one panel at any point up to 42 inches (1067 mm) above the walking surface.

2403.5 Louvered windows or jalousies. Float, wired and patterned glass in louvered windows and jalousies shall be not thinner than nominal $^3/_{16}$ inch (4.8 mm) and not longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

Wired glass with wire exposed on longitudinal edges shall not be used in louvered windows or jalousies.

Where other glass types are used, the design shall be submitted to the building official for approval.

SECTION 2404—WIND, SNOW, SEISMIC AND DEAD LOADS ON GLASS

2404.1 Vertical glass. Glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads due to basic wind speed, *V*, in Section 1609 for components and cladding. Glass in glazed curtain walls, glazed storefronts and glazed partitions shall meet the seismic requirements of ASCE 7, Section 13.5.9. The load resistance of glass under uniform load shall be determined in accordance with ASTM E1300.

The design of vertical glazing shall be based on Equation 24-1.

Equation 24-1 $0.6F_{gw} \le F_{ga}$

where:

F_{gw} = Wind load on the glass due to basic wind speed, *V*, computed in accordance with Section 1609.

F_{ga} = Short duration load on the glass as determined in accordance with ASTM E1300.

2404.2 Sloped glass. Glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunrooms, sloped roofs and other exterior applications shall be designed to resist the most critical combinations of loads determined by Equations 24-2, 24-3 and 24-4.

Equation 24-2 $F_g = 0.6W_o - D$

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Equation 24-3 $F_g = 0.6W_i + D + 0.35S$

Equation 24-4 $F_g = 0.3W_i + D + 0.7S$

where:

D = Glass dead load psf (kN/m^2).

For glass sloped 30 degrees (0.52 rad) or less from horizontal, = 13 t_g (For SI: 0.0245 t_g).

For glass sloped more than 30 degrees (0.52 rad) from horizontal, = 13 $t_g \cos\theta$ (For SI: 0.0245 $t_g \cos\theta$).

F_g = Total load, psf (kN/m^2) on glass.

S = Snow load, psf (kN/m^2) as determined in Section 1608 from the reliability-targeted (strength-based) maps in Figures 1608.2(1) through 1608.2(4).

t_g = Total glass thickness, inches (mm) of glass panes and plies.

W_i = Inward wind force, psf (kN/m^2) due to basic wind speed, V, as calculated in Section 1609.

W_o = Outward wind force, psf (kN/m^2) due to basic wind speed, V, as calculated in Section 1609.

θ = Angle of slope from horizontal.

Exception: The performance grade rating of unit skylights and tubular daylighting devices shall be determined in accordance with Section 2405.5.

The design of sloped glazing shall be based on Equation 24-5.

Equation 24-5 $F_g \le F_{ga}$

where:

F_g = Total load on the glass as determined by Equations 24-2, 24-3 and 24-4.

F_{ga} = Short duration load resistance of the glass as determined in accordance with ASTM E1300 for Equations 24-2 and 24-3; or the long duration load resistance of the glass as determined in accordance with ASTM E1300 for Equation 24-4.

2404.3 Wired, patterned and sandblasted glass.

2404.3.1 Vertical wired glass. Wired glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

Equation 24-6 $0.6F_{gw} < 0.5\ F_{ge}$

where:

F_{gw} = Wind load on the glass due to basic wind speed, V, computed in accordance with Section 1609.

F_{ge} = Nonfactored load from ASTM E1300 using a thickness designation for monolithic glass that is not greater than the thickness of wired glass.

2404.3.2 Sloped wired glass. Wired glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sun-spaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

Equation 24-7 $F_g < 0.5\ F_{ge}$

For Equation 24-4:

Equation 24-8 $F_g < 0.3\ F_{ge}$

where:

F_g = Total load on the glass as determined by Equations 24-2, 24-3 and Equation 24-4.

F_{ge} = Nonfactored load in accordance with ASTM E1300.

2404.3.3 Vertical patterned glass. Patterned glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to Equation 24-9.

Equation 24-9 $F_{gw} < 1.0\ F_{ge}$

where:

F_{gw} = Wind load on the glass due to basic wind speed, V, computed in accordance with Section 1609.

F_{ge} = Nonfactored load in accordance with ASTM E1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between nonfactored load charts in ASTM E1300 shall be permitted.

2404.3.4 Sloped patterned glass. Patterned glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

Equation 24-10 $F_g < 1.0F_{ge}$

For Equation 24-4:

Equation 24-11 $F_g < 0.6F_{ge}$

where:

F_g = Total load on the glass as determined by Equations 24-2, 24-3 and Equation 24-4.

F_{ge} = Nonfactored load in accordance with ASTM E1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between the nonfactored *load* charts in ASTM E1300 shall be permitted.

2404.3.5 Vertical sandblasted glass. Sandblasted glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors, and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to Equation 24-12.

Equation 24-12 $0.6F_{gw} < 0.5F_{ge}$

where:

F_g = Wind load on the glass due to basic wind speed, V, computed in accordance with Section 1609.

F_{ge} = Nonfactored load in accordance with ASTM E1300. The value for sandblasted glass is for moderate levels of sandblasting.

2404.4 Other designs. For designs outside the scope of this section, an analysis or test data for the specific installation shall be prepared by a registered design professional.

SECTION 2405—SLOPED GLAZING AND SKYLIGHTS

2405.1 Scope. This section applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope of more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs and sloped walls.

2405.2 Allowable glazing materials and limitations. Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of Section 2606, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in Item 1.

Annealed glass is permitted to be used as specified in Exceptions 2 and 3 of Section 2405.3.

Laminated glass and plastic materials described in Items 1 and 2 shall not require the screening or height restrictions provided in Section 2405.3.

For additional requirements for plastic skylights, see Section 2610. Glass-block construction shall conform to the requirements of Section 2110.1.

2405.3 Screening. Broken glass retention screens, where required, shall be capable of supporting twice the weight of the glazing, firmly and substantially fastened to the framing members and installed within 4 inches (102 mm) of the glass. The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used.

2405.3.1 Screens under monolithic glazing. Heat-strengthened glass and fully tempered glass shall have screens installed below the full area of the glazing material.

2405.3.2 Screens under multiple-layer glazing. Heat-strengthened glass, fully tempered glass and wired glass used as the bottom glass layer shall have screens installed below the full area of the glazing material.

2405.3.3 Screening not required in monolithic and multiple-layer sloped glazing systems. In monolithic and multiple-layer sloped glazing systems, retention screens are not required for any of the following:

1. Fully tempered glass where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane, and the highest point of the glass is 10 feet (3048 mm) or less above the walking surface.
2. Any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
3. Any glazing material, including annealed glass, in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.
4. Individual dwelling units in Groups R-2, R-3 and R-4 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and all of the following conditions are met:
   4.1. Each pane of the glass is 16 square feet (1.5 m^2) or less in area.
   4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.
   4.3. The glass thickness is $^3/_{16}$ inch (4.8 mm) or less.
5. Laminated glass with a 15-mil (0.38 mm) polyvinyl butyral or equivalent interlayer used in individual dwelling units in Groups R-2, R-3 and R-4 where both of the following conditions are met:
   5.1. Each pane of glass is 16 square feet (1.5 m^2) or less in area.
   5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

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2405.3.4 Screens not required. For all types of glazing not specifically noted in Sections 2405.3.1 through 2405.3.3 and complying with Section 2405.2, retention screens shall not be required.

2405.4 Framing. In Types I and II construction, sloped glazing and skylight frames shall be constructed of noncombustible materials. In structures where acid fumes deleterious to metal are incidental to the use of the buildings, approved pressure-treated wood or other approved noncorrosive materials are permitted to be used for sash and frames. Framing supporting sloped glazing and skylights shall be designed to resist the tributary roof loads in Chapter 16. Skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal plane shall be mounted not less than 4 inches (102 mm) above the plane of the roof on a curb constructed as required for the frame. Skylights shall not be installed in the plane of the roof where the roof pitch is less than 45 degrees (0.79 rad) from the horizontal.

Exception: Installation of a skylight without a curb shall be permitted on roofs with a minimum slope of 14 degrees (three units vertical in 12 units horizontal) in Group R-3 occupancies. Unit skylights installed in a roof with a pitch flatter than 14 degrees (0.25 rad) shall be mounted not less than 4 inches (102 mm) above the plane of the roof on a curb constructed as required for the frame unless otherwise specified in the manufacturer's installation instructions.

2405.5 Unit skylights and tubular daylighting devices. Unit skylights and tubular daylighting devices shall be tested and labeled as complying with AAMA/WDMA/CSA 101/I.S./A440. The label shall state the name of the manufacturer, the approved labeling agency, the product designation and the performance grade rating as specified in AAMA/WDMA/CSA 101/I.S.2/A440. Where the product manufacturer has chosen to have the performance grade of the skylight rated separately for positive and negative design pressure, then the label shall state both performance grade ratings as specified in AAMA/WDMA/CSA 101/I.S.2/A440 and the skylight shall comply with Section 2405.5.2. Where the skylight is not rated separately for positive and negative pressure, then the performance grade rating shown on the label shall be the performance grade rating determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for both positive and negative design pressure and the skylight shall conform to Section 2405.5.1.

2405.5.1 Skylights rated for the same performance grade for both positive and negative design pressure. The design of skylights shall be based on Equation 24-13.

Equation 24-13 $F_g \leq PG$

where:

F_g = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

PG = Performance grade rating of the skylight.

2405.5.2 Skylights rated for separate performance grades for positive and negative design pressure. The design of skylights rated for performance grade for both positive and negative design pressures shall be based on Equations 24-14 and 24-15.

Equation 24-14 $F_{gi} \leq PG_{Pos}$

Equation 24-15 $F_{go} \leq PG_{Neg}$

where:

PG_{Pos} = Performance grade rating of the skylight under positive design pressure;

PG_{Neg} = Performance grade rating of the skylight under negative design pressure; and

F_{gi} and F_{go} are determined in accordance with the following:

For $0.6W_o \geq D$,

where:

W_o = Outward wind force, psf (kN/m^2) due to basic wind speed, V, as calculated in Section 1609.

D = The dead weight of the glazing, psf (kN/m^2) as determined in Section 2404.2 for glass, or by the weight of the plastic, psf (kN/m^2) for plastic glazing.

F_{gi} = Maximum load on the skylight determined from Equations 24-3 and 24-4 in Section 2404.2.

F_{go} = Maximum load on the skylight determined from Equation 24-2.

For $0.6W_o < D$,

where:

W_o = The outward wind force, psf (kN/m^2) due to basic wind speed, V, as calculated in Section 1609.

D = The dead weight of the glazing, psf (kN/m^2) as determined in Section 2404.2 for glass, or by the weight of the plastic for plastic glazing.

F_{gi} = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

F_{go} = 0.

SECTION 2406—SAFETY GLAZING

2406.1 Human impact loads. Glazed areas in hazardous locations as defined in Section 2406.4, including glass mirrors, single panes of glass, laminated glass and panes in multipane glass assemblies, shall comply with Sections 2406.1.1 through 2406.1.4.

Exception: Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

2406.1.1 Impact test. Except as provided in Sections 2406.1.2 through 2406.1.4, all glazing shall pass the impact test requirements of Section 2406.2.

2406.1.2 Plastic glazing. Plastic glazing shall meet the weathering requirements of ANSI Z97.1.

2406.1.3 Glass block. Glass-block walls shall comply with Section 2110.

2406.1.4 Louvered windows and jalousies. Louvered windows and jalousies shall comply with Section 2403.5.

2406.2 Impact test. Where required by other sections of this code, glazing shall be tested in accordance with CPSC 16 CFR Part 1201. Glazing shall comply with the test criteria for Category II, unless otherwise indicated in Table 2406.2(1).

Exception: Glazing not in doors or enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers shall be permitted to be tested in accordance with ANSI Z97.1. Glazing shall comply with the test criteria for Class A, unless otherwise indicated in Table 2406.2(2).

TABLE 2406.2(1)—MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING CPSC 16 CFR PART 1201

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category class)	GLAZING IN DOORS (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.3 (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.2 (Category class)	DOORS AND ENCLOSURES REGULATED BY SECTION 2406.4.5 (Category class)	SLIDING GLASS DOORS PATIO TYPE (Category class)
9 square feet or less	I	I	No requirement	I	II	II
More than 9 square feet	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m^2.

TABLE 2406.2(2)—MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING ANSI Z97.1

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZED PANELS REGULATED BY SECTION 2406.4.3 (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.2 (Category class)	DOORS AND ENCLOSURES REGULATED BY SECTION 2406.4.5[a] (Category class)
9 square feet or less	No requirement	B	A
More than 9 square feet	A	A	A

For SI: 1 square foot = 0.0929 m^2.
a. Use is only permitted by the exception to Section 2406.2.

2406.3 Identification of safety glazing. Except as indicated in Section 2406.3.1, each pane of safety glazing installed in hazardous locations shall be identified by a manufacturer's designation specifying who applied the designation, the manufacturer or installer and the safety glazing standard with which it complies, as well as the information specified in Section 2403.1. The designation shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that once applied, cannot be removed without being destroyed. A label meeting the requirements of this section shall be permitted in lieu of the manufacturer's designation.

Exceptions:

1. For other than tempered glass, manufacturer's designations are not required, provided that the building official approves the use of a certificate, affidavit or other evidence confirming compliance with this code.
2. Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper designation.

2406.3.1 Multipane assemblies. Multipane glazed assemblies having individual panes not exceeding 1 square foot (0.09 m^2) in exposed areas shall have one pane or more in the assembly marked as indicated in Section 2406.3. Other panes in the assembly shall be marked "CPSC 16 CFR Part 1201" or "ANSI Z97.1," as appropriate.

2406.4 Hazardous locations. The locations specified in Sections 2406.4.1 through 2406.4.7 shall be considered to be specific hazardous locations requiring safety glazing materials.

2406.4.1 Glazing in doors. Glazing in all fixed and operable panels of swinging, sliding and bifold doors shall be considered to be a hazardous location.

Exceptions:

1. Glazed openings of a size through which a 3-inch-diameter (76 mm) sphere is unable to pass.
2. Decorative glazing.
3. Glazing materials used as curved glazed panels in revolving doors.
4. Commercial refrigerated cabinet glazed doors.

2406.4.2 Glazing adjacent to doors. Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the walking surface shall be considered to be a hazardous location.

Exceptions:

1. Decorative glazing.
2. Where there is an intervening wall or other permanent barrier between the door and glazing.

3. Where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with Section 2406.4.3.
4. Glazing in walls on the latch side of and perpendicular to the plane of the door in a closed position in one- and two-family dwellings or within dwelling units in Group R-2.

2406.4.3 Glazing in windows. Glazing in an individual fixed or operable panel that meets all of the following conditions shall be considered to be a hazardous location:

1. The exposed area of an individual pane is greater than 9 square feet (0.84 m^2).
2. The bottom edge of the glazing is less than 18 inches (457 mm) above the floor or adjacent walking surface.
3. The top edge of the glazing is greater than 36 inches (914 mm) above the floor or adjacent walking surface.
4. One or more walking surface(s) are within 36 inches (914 mm), measured horizontally and in a straight line, of the plane of the glazing.

Exceptions:

1. Decorative glazing.
2. Where a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be not less than $1^1/_2$ inches (38 mm) in cross-sectional height.
3. Outboard panes in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 8 feet (2438 mm) or more above any grade or walking surface adjacent to the glass exterior.

2406.4.4 Glazing in guards and railings. Glazing in guards and railings, including structural baluster panels and nonstructural infill panels, regardless of area or height above a walking surface shall be considered to be a hazardous location.

2406.4.5 Glazing and wet surfaces. Glazing in walls, enclosures or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface shall be considered to be a hazardous location. This shall apply to single glazing and all panes in multiple glazing.

Exception: Glazing that is more than 60 inches (1524 mm), measured horizontally and in a straight line, from the water's edge of a bathtub, hot tub, spa, whirlpool or swimming pool.

2406.4.6 Glazing adjacent to stairways and ramps. Glazing where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered to be a hazardous location.

Exceptions:

1. The side of a stairway, landing or ramp that has a guard complying with the provisions of Sections 1015 and 1607.9, and the plane of the glass is greater than 18 inches (457 mm) from the railing.
2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.

2406.4.7 Glazing adjacent to the bottom stairway landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 60 inches (1524 mm) above the landing and within a 60-inch (1524 mm) horizontal arc that is less than 180 degrees (3.14 rad) from the bottom tread nosing shall be considered to be a hazardous location.

Exception: Glazing that is protected by a guard complying with Sections 1015 and 1607.9 where the plane of the glass is greater than 18 inches (457 mm) from the guard.

2406.5 Fire department access panels. Fire department glass access panels shall be of tempered glass. For multipanel glass assemblies, all panes shall be tempered glass.

SECTION 2407—GLASS IN HANDRAILS AND GUARDS

2407.1 Materials. Glass used in a handrail or a guard shall be laminated glass constructed of fully tempered or heat-strengthened glass and shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1. Glazing in a handrail or a guard shall be of an approved safety glazing material that conforms to the provisions of Section 2406.1.1. For all glazing types, the minimum nominal thickness shall be $^1/_4$ inch (6.4 mm).

Exception: Single fully tempered glass complying with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1 shall be permitted to be used in handrails and guards where there is no walking surface beneath them or the walking surface is permanently protected from the risk of falling glass.

2407.1.1 Loads. Glass handrails and guards and their support systems shall be designed to withstand the loads specified in Section 1607.9. Calculated stresses for the loads specified in Section 1607.9 shall be less than or equal to 3,000 pounds per square inch (20.7 MPa) for heat-strengthened glass and less than or equal to 6,000 pounds per square inch (41.4 MPa) for fully tempered glass.

2407.1.2 Guards with structural glass balusters. Guards with structural glass balusters, whether vertical posts, columns or panels, shall be installed with an attached top rail or handrail. The top rail or handrail shall be supported by not fewer than three glass balusters, or shall be otherwise supported to remain in place should one glass baluster fail.

Exception: An attached top rail or handrail is not required where the glass baluster panels are laminated glass with two or more glass plies of equal thickness and of the same glass type. The balusters shall be tested to remain in place as a barrier following impact or glass breakage in accordance with ASTM E2353.

2407.1.3 Parking garages. Glazing materials shall not be installed in handrails or guards in parking garages except for pedestrian areas not exposed to impact from vehicles.

2407.1.4 Glazing in windborne debris regions. Glazing installed in exterior handrails or guards in windborne debris regions shall be laminated glass complying with Category II of CPSC 16 CFR 1201 or Class A of ANSI Z97.1. Where the top rail is supported by glass, the assembly shall be tested according to the impact requirements of Section 1609.2 and the top rail shall remain in place after impact.

SECTION 2408—GLAZING IN ATHLETIC FACILITIES

2408.1 General. Glazing in athletic facilities and similar uses subject to impact loads, which forms whole or partial wall sections or which is used as a door or part of a door, shall comply with this section.

2408.2 Racquetball and squash courts.

2408.2.1 Testing. Test methods and loads for individual glazed areas in racquetball and squash courts subject to impact loads shall conform to those of CPSC 16 CFR Part 1201 or ANSI Z97.1 with impacts being applied at a height of 59 inches (1499 mm) above the playing surface to an actual or simulated glass wall installation with fixtures, fittings and methods of assembly identical to those used in practice.

Glass walls shall comply with the following conditions:

1. A glass wall in a racquetball or squash court, or similar use subject to impact loads, shall remain intact following a test impact.
2. The deflection of such walls shall be not greater than $1^1/_2$ inches (38 mm) at the point of impact for a drop height of 48 inches (1219 mm).

Glass doors shall comply with the following conditions:

1. Glass doors shall remain intact following a test impact at the prescribed height in the center of the door.
2. The relative deflection between the edge of a glass door and the adjacent wall shall not exceed the thickness of the wall plus $^1/_2$ inch (12.7 mm) for a drop height of 48 inches (1219 mm).

2408.3 Gymnasiums and basketball courts. Glazing in multipurpose gymnasiums, basketball courts and similar athletic facilities subject to human impact loads shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1.

SECTION 2409—GLASS IN WALKWAYS, ELEVATOR HOISTWAYS AND ELEVATOR CARS

2409.1 Glass walkways. Glass installed as a part of a floor/ceiling assembly as a walking surface and constructed with laminated glass shall comply with either of the following:

1. ASTM E2751.
2. Load requirements specified in Chapter 16 and approval in accordance with the provisions of Section 104.2.3.

Such assemblies shall comply with the fire-resistance rating and marking requirements of this code where applicable.

2409.2 Glass in elevator hoistway enclosures. Glass in elevator hoistway enclosures and hoistway doors shall be laminated glass conforming to ANSI Z97.1 or CPSC 16 CFR Part 1201.

2409.2.1 Fire-resistance-rated hoistways. Glass installed in hoistways and hoistway doors where the hoistway is required to have a fire-resistance rating shall comply with Section 716.

2409.2.2 Glass hoistway doors. The glass in glass hoistway doors shall be not less than 60 percent of the total visible door panel surface area as seen from the landing side.

2409.3 Visions panels in elevator hoistway doors. Glass in vision panels in elevator hoistway doors shall be permitted to be any transparent glazing material not less than $^1/_4$ inch (6.4 mm) in thickness conforming to Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201. The area of any single vision panel shall be not less than 24 square inches (15 484 mm^2) and the total area of one or more vision panels in any hoistway door shall be not more than 85 square inches (54 839 mm^2).

2409.4 Glass in elevator cars. Glass in elevator cars shall be in accordance with this section.

2409.4.1 Glass types. Glass in elevator car enclosures, glass elevator car doors and glass used for lining walls and ceilings of elevator cars shall be laminated glass conforming to Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201.

Exception: Tempered glass shall be permitted to be used for lining walls and ceilings of elevator cars provided that:

1. The glass is bonded to a nonpolymeric coating, sheeting or film backing having a physical integrity to hold the fragments when the glass breaks.
2. The glass is not subjected to further treatment such as sandblasting; etching; heat treatment or painting that could alter the original properties of the glass.
3. The glass is tested to the acceptance criteria for laminated glass as specified for Class A in accordance with ANSI Z97.l or Category II in accordance with CPSC 16 CFR Part 1201.

2409.4.2 Surface area. The glass in glass elevator car doors shall be not less than 60 percent of the total visible door panel surface area as seen from the car side of the doors.

SECTION 2410-[DSA-SS, DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] STRUCTURAL SEALANT GLAZING (SSG)

2410.1 General. *The requirements of this section address the use of structural sealant glazing (SSG). These requirements shall not be used for butt joint glazing, point supported glass and glass fins.*

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 2410.1.1 through 2410.1.4.

Exception: [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

2410.1.1 Design. *Design of SSG shall satisfy the following requirements:*

1. *SSG shall be weather tight and serviceable, as defined in AAMA 501.4, under design story drifts associated with the design earthquake and no glass fallout shall occur at the drifts determined by ASCE 7, Section 13.5.9.*
2. *The sealant utilized in the insulated glass units used in SSG shall be designed in accordance with ASTM C1249. The insulated glass unit design shall be in accordance with ASTM C1249, Section 6.7.2.*
3. *Allowable stress for SSG shall not exceed 20 psi and shall have a minimum factor of safety of 5 as required by ASTM C1401.*
4. *Design methodology shall address seismic movement in accordance with ASTM C1401, Section 30.3.4.*
5. *SSG systems shall be supported for self-weight and lateral loading at each floor level of the building.*
6. *Unitized SSG framing shall be anchored to the building floor bearing plate by screws or bolts and shall not rely upon gravity or frictional forces for attachment.*
7. *Framing shall satisfy the out-of-plane deflection requirements of this code.*

2410.1.2 Testing and inspection. *Testing and inspection of SSG shall satisfy the following requirements:*

1. *The seismic drift capability of SSG shall be determined by tests in accordance with AAMA 501.6 and AAMA 501.4. Analysis as an alternative to testing is not acceptable for the purposes of satisfying the seismic drift requirements of the SSG system.*

   Exception: [DSA-SS, DSA-SS/CC] *In Risk Category I, II and III buildings the seismic drift capacity can be determined by engineering analysis in accordance with ASCE 7, Section 13.5.9 for two-sided SSG systems in which the other two sides of each glazing unit are mechanically captured by mullions such that glass fallout is prevented even in the event of the structural sealant failure.*
2. *The applicability of the specific AAMA 501.6 and AAMA 501.4 testing shall be subject to approval by the building official.*
3. *The panel test specimens used in the AAMA 501.6 and AAMA 501.4 testing shall include all glass types (annealed, heat strengthened, laminated, tempered) and insulated glass units that comprise more than 5 percent of the total glass curtain wall area used in the building.*
4. *AAMA 501.4 test specimen shall include the same materials, sections, connections and attachment details to the test apparatus as used in the building.*
5. *Serviceability tests of SSG test specimen shall be performed in accordance with AAMA 501.4 after seismic displacement tests to the design story drift.*
6. *The window wall system using structural sealant by different manufacturer/product category shall be qualified in accordance with AAMA 501.6 and AAMA 501.4 testing for the seismic drift required.*
7. *Where unitized SSG is used with horizontal stack joints at each floor level and split vertical mullions that can move independently, only a story height single unit need to be tested under AAMA 501.6. Where continuous horizontal bands of SSG are used in the building, either two or four sided, the aspect ratio (height-to-length) of the test specimen shall be less than 1.0, contain not less than two interior vertical joints and all joints (vertical in the case of two sided), including the perimeter of the glass, shall be glazed with SSG.*
8. *Where SSG continues around corners, the AAMA 501.4 test specimen shall include one corner panel to verify the kinematics of the corner condition under seismic drift.*
9. *Quality assurance and inspection requirements shall include formalized post-installation tests using the point load testing procedure in accordance with ASTM C1392. The point load tests shall be done after the initial installation.*
10. *Where the SSG is field assembled, hand pull tab tests in accordance with ASTM C1401, Section X2.1, one test every 100 linear feet, but not less than one test for each building elevation view shall be required.*

Existing AAMA 501.4 and 501.6 test results satisfying the requirements of this section shall be permitted, in lieu of project specific tests, when approved by the building official.

2410.1.3 Monitoring. *Short- and long-term periodic performance monitoring shall be provided in accordance with ASTM C1401, C1392 and C1394 at frequencies recommended in ASTM C1394.*

2410.1.4 Construction documents. *Complete design of the SSG system for gravity, wind and seismic forces shall be subject to review by the enforcement agency. Construction documents shall show descriptive notes and structural details of glass and curtain wall system including:*

1. *A design narrative explaining how the SSG is supported by the building and the mechanism used to accommodate seismic racking.*
2. *Type of SSG and whether field or shop built.*
3. *The means of supporting the glass during structural sealant curing time.*

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4. *Typical curtain wall panel elevation, plan view and sections.*
5. *Details of building corner joint to verify how the corner vertical mullion will move to accommodate the seismic drift.*
6. *Joints between panel and floors at top and bottom.*
7. *Joints between panels, including vertical and horizontal stack joints at intermediate and edge mullion.*
8. *Member sizes for curtain wall panels.*
9. *Glass pane sizes, thickness and type of glass.*
10. *Contact width and thickness of structural sealant and sealant materials for shop and field installation/reglazing.*
11. *Glass to aluminum joints (including primers, if any).*
12. *Maximum roof/floor dead and live load deflection of the roof/floor framing members supporting the exterior curtain wall system.*
13. *Required seismic separation or gap distance between the SSG curtain wall and other adjacent cladding units.*
14. *Mitigation of galvanic reactions between the roof/floor slab anchors, steel screw connections of aluminum sections and the aluminum anchorage components, if any.*
15. *Monitoring requirements per Section 2410.1.3.*

SECTION 2411 [OSHPD 1, 1R, 2, 4 & 5]-THERMAL BARRIERS IN ALUMINUM MULLION SYSTEMS

2411.1 General. *The requirements of this section address the use of thermal barriers composite in aluminum mullion systems. The thermal barriers shall consist of either poured and debridged or mechanically locked pre-formed construction. The thermal barrier systems used shall be those tested and complying with AAMA TIR-A8. The thermal barrier manufacturer, formulation number or insulating strut size/material and aluminum extrusions shall be consistent between testing, design and construction.*

Exception: *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

2411.1.1 Structural Design. *Structural design of thermal barrier mullions shall satisfy the following requirements:*

1. *The allowable design stresses for thermal barrier materials composite with aluminum extrusions shall be determined by AAMA TIR-A8 testing for in-plane shear, tension and eccentric load at a minimum of ambient and high temperature using a factor of safety determined by AAMA TIR-A8 Section 6.7.*
2. *The shear modulus, G_c, of the thermal barrier in similar composite aluminum extrusions shall be determined by AAMA TIR-A8 testing for flexure in AAMA TIR-A8 Section 7.2 at a minimum of ambient and high temperature.*
3. *The aluminum extrusions used to determine allowable stresses in the thermal barriers and the shear modulus, G_c, shall be from a specific aluminum extrusion manufacturer and the aluminum sections used in the project. The similarity of the composite aluminum extrusions shall be subject to approval by the building official.*
4. *The effective moment of inertia of the in-plane composite thermal barrier-aluminum section used in flexural design, based upon the tested G_c, shall not exceed 85 percent of the moment of inertia of the combined unbridged aluminum portions of the composite section, unless substantiated and approved by the building official.*
5. *A high temperature of not less than 120°F shall be used for composite section flexure design for wind pressure where the historical high temperature exceeds 100°F. The minimum high temperature for in-plane shear, tension and eccentric load thermal barrier design shall be determined by AAMA TIR-A8 Section 6.5.*
6. *The lowest allowable stress value and shear modulus, G_c, from the ambient and high temperature testing shall be used for design.*
7. *Structural analysis and design for loads on pour and debridged thermal barriers with skip-debridging that has not been tested under AAMA TIR-A8 with skip-debridged test specimens for the specific actions or load direction shall be based upon the relative stiffness between the remaining aluminum bridge and the thermal barrier material and size.*
8. *Reactions on supporting thermal barrier mullions where the thermal barrier resists the concentrated load, the load shall not be assumed to be distributed over a length greater than 12 inches (305 mm) on the supporting mullion.*
9. *Mechanically locked, preformed thermal barriers shall be designed and used in pairs.*

2411.1.2 Testing and Inspection. *Testing and Inspection of thermal barrier mullions shall satisfy the following requirements:*

1. *Thermal barrier material properties shall be tested in accordance with AAMA TIR-A8 Section 6.1 by the manufacturer. All other testing shall done by an approved testing laboratory or agency.*
2. *Testing shall include AAMA TIR-A8 Section 7.2 for the flexural tests using the composite section under ambient and high temperature. Thermocouples shall be placed on the outside and interior surfaces and in the middle of the thermal barrier for high temperature testing. Test cycles shall be in accordance with AAMA TIR-A8 Section 7.2.3.*
3. *Testing shall include AAMA TIR-A8 Section 7.3 for in-plane shear, tension and eccentric load using the composite section under ambient and high temperature.*
4. *The flexural test for the composite section shall include a span length of 12 feet (3660 mm). The maximum P load in the test shall generate close to a L/175 deflection, where L is the span length, center to center of supports, but shall not exceed the allowable design stresses for the aluminum composite section in meeting that deflection. Permanent deflection shall not exceed the requirement in AAMA TIR-A8 Section 7.2.2.5.*

5. *A minimum of two different simple span lengths shall be used to determine G_c under the flexural test. The span lengths tested shall include a short span.*
6. *The shear modulus, G_c, of the thermal barrier shall be determined using the lowest average I_{et} from the flexural testing for each composite aluminum extrusion, temperature and span length tested.*
7. *Each different composite aluminum extrusion in the project shall be tested to the requirements of AAMA TIR-A8. The magnitude of eccentricity of load on the thermal barrier shall be considered in selecting composite aluminum extrusions for testing.*
8. *The applicability of existing AAMA TIR-A8 testing of thermal barrier mullions that satisfy the requirements of this section shall be permitted, in lieu of project-specific tests, when approved by the building official.*
9. *Periodic special inspection to ensure compliance with the AAMA TIR-A8 processing for the thermal isolator material shall be performed. Inspections shall include tests of thermal barrier material properties per the manufacturer's recommendation and AAMA TIR-A8 Section 6.1 and composite performance requirements per AAMA TIR-A8 Sections 7.2 and 7.3.*
10. *Periodic special inspection of pour and debridge thermal barrier shall include:*
    a. *Verification that the thermal barrier formulation being used matches that in the design and construction documents.*
    b. *Verification that poured wet or dry shrinkage as set forth in AAMA TIR-A8 Section 4.1.3.1 does not occur.*
    c. *Proper adhesion of poured thermal barrier material per AAMA TIR-A8 Section 4.2.1.*
    d. *Confirmation of proper manufacturing process per the manufacturer's recommendations and AAMA TIR-A8 Section 4.3.*
    e. *Inspection of fabrication and handling practices in accordance with AAMA TIR-A8 Sections 4.3 and 4.4.*
    f. *Testing for thermal barrier material properties per the manufacturer's recommendation and AAMA TIR-A8 Section 6.1.*
    g. *Periodic special inspection of the removal of the temporary thermal bridge shall be provided to ensure that no thermal barrier material is removed in the process.*
11. *Periodic special inspection of mechanically locked, preformed thermal barriers shall include:*
    a. *Verification that the insulating struts being used match those in the design and construction documents.*
    b. *Verification that the mechanical lock cavity distortion and locking distortion does not exist as set forth in AAMA TIR-A8 Sections 4.1.3.3 and 4.1.3.4.*
    c. *Verification of proper knurling of the aluminum and crimping of the insulating struts per AAMA TIR-A8 Section 4.2.2.*
    d. *Confirmation of proper manufacturing process per the manufacturer's recommendations and AAMA TIR-A8 Section 4.5.*
    e. *Inspection of fabrication and handling practices in accordance with AAMA TIR-A8 Sections 4.5 and 4.6.*

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 25 – GYPSUM PANEL PRODUCTS AND PLASTER

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X			X	X								X			X								
Adopt entire chapter as amended (amended sections listed below)								X	X	X	X	X		X	X									
Adopt only those sections that are listed below																					X			
Chapter / Section																								
2501.1.1								X	X	X	X	X		X	X									
2501.1.2								X	X	X	X	X		X	X									
2501.1.3								X	X	X	X	X		X	X									
2503.2								X	X	X	X	X		X	X									
2503.2, Exception												X												
2504.2								X	X	X	X	X		X	X									
2504.2.1, Exception												X												
2505.3								X	X	X	X	X		X	X									
2505.3, Exception												X												
2507.3								X	X	X	X	X		X	X									
2508.6.6								X	X	X	X	X		X	X									
2508.6.6, Exception												X												
2510.6.3																					X			
2514.1, *Exception*								X		X	X	X		X	X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

25

GYPSUM PANEL PRODUCTS AND PLASTER

User notes:

About this chapter: Chapter 25 contains the provisions and referenced standards that regulate the design, construction and quality of gypsum panel products and plaster and, in addition, addresses reinforced gypsum concrete. These materials are some of the most commonly used interior and exterior finish materials in the building industry. This chapter primarily addresses quality-control-related issues with regard to material specifications and installation requirements. Most products are manufactured in accordance with industry standards. The building official or inspector needs to verify that the appropriate product is used and properly installed for the intended use and location. Proper design and installation of these materials are necessary to provide weather resistance and required fire protection for both structural and nonstructural building components.

ICC code development note: Code change proposals to sections preceded by the designation [BF] will be considered by a code development committee meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION 2501—GENERAL

2501.1 Scope. Provisions of this chapter shall govern the materials, design, construction and quality of gypsum panel products, lath, gypsum plaster, cement plaster and reinforced gypsum concrete.

2501.1.1 Application. [DSA-SS, DSA-SS/CC & OSHPD] *The scope of application of Chapter 25 is as follows:*

1. *Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Department of Health Care Access and Information/Office of Statewide Hospital Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.*
2. *Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings*

2501.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC, OSHPD] *DSA-SS, DSA-SS/CC, OSHPD adopt this chapter as amended.*

1. *OSHPD amendments appear in this chapter preceded with the appropriate acronym, as follows:*

   [OSHPD 1] *- For applications listed in Section 1.10.1.*

   [OSHPD 1R] *- For applications listed in Section 1.10.1.*

   [OSHPD 2] *- For applications listed in Section 1.10.2.*

   [OSHPD 4] *- For applications listed in Section 1.10.4.*

   [OSHPD 5] *- For applications listed in Section 1.10.5.*
2. *Division of the State Architect - Structural Safety amendments appear in this chapter preceded by the appropriate acronym, as follows:*

   [DSA-SS] *- For applications listed in Section 1.9.2.1.*

   [DSA-SS/CC] *- For applications listed in Section 1.9.2.2.*

2501.1.3 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *Details of attachment for wall and ceiling coverings which are not provided for in this code shall be detailed in the approved construction documents.*

Exception: *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

2501.2 Other materials. Other approved wall or ceiling coverings shall be permitted to be installed in accordance with the recommendations of the manufacturer and the conditions of approval.

SECTION 2502—PERFORMANCE

2502.1 General. Lathing, plastering and gypsum panel product construction shall be done in the manner and with the materials specified in this chapter and, where required for fire protection, shall comply with the provisions of Chapter 7.

SECTION 2503—INSPECTION

2503.1 Inspection. Lath and gypsum panel products shall be inspected in accordance with Section 110.3.6.

2503.2 Additional requirements for inspection and testing. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5]

1. *Lath, gypsum board and gypsum panel products shall be inspected in accordance with Chapter 17A and the California Administrative Code.*
2. *No lath, gypsum board and gypsum panel products or their attachments shall be covered or finished until it has been inspected and approved by the inspector of record and/or special inspector.*

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3. *The enforcement agency shall be permitted to require tests in accordance with Table 2506.2 to determine compliance with the provisions of this code.*
4. *The testing of gypsum board and gypsum panel products shall conform with standards listed in Table 2506.2*

Exception: [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

SECTION 2504—VERTICAL AND HORIZONTAL ASSEMBLIES

2504.1 Scope. The following requirements shall be met where construction involves gypsum panel products or lath and plaster in vertical and horizontal assemblies.

2504.1.1 Wood framing. Wood supports for lath or gypsum panel products, as well as wood stripping or furring, shall be not less than 2 inches (51 mm) nominal thickness in the least dimension.

Exception: The minimum nominal dimension of wood furring strips installed over solid backing shall be not less than 1 inch by 2 inches (25 mm by 51 mm).

2504.1.2 Studless partitions. The minimum thickness of vertically erected studless solid plaster partitions of $^{3}/_{8}$-inch (9.5 mm) and $^{3}/_{4}$-inch (19.1 mm) rib metal lath, $^{1}/_{2}$-inch-thick (12.7 mm) gypsum lath or gypsum panel product shall be 2 inches (51 mm).

2504.2 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *In addition to the requirements of this section, the horizontal and vertical assemblies of plaster, gypsum board or gypsum panel products shall be designed to resist the loads specified in this code.*

2504.2.1 Wood furring strips. *Wood furring strips for ceilings fastened to floor or ceiling joist shall be nailed at each bearing with two common wire nails, one of which shall be a slant nail and the other a face nail, or by one nail having spirally grooved or annular grooved shanks approved by the enforcement agency for this purpose. All stripping nails shall penetrate not less than $1^{3}/_{4}$ inches (44.5 mm) into the member receiving the point. Holes in stripping at joints shall be subdrilled to prevent splitting.*

Where common wire nails are used to support horizontal wood stripping for plaster ceilings, such stripping shall be wire tied to the joists 4 feet (1219 mm) on center with two strands of No. 18 W&M gage galvanized annealed wire to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist, and the ends of the wire secured together with three twists of the wire.

Exception: [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

SECTION 2505—SHEAR WALL CONSTRUCTION

2505.1 Resistance to shear (wood framing). Wood-frame shear walls sheathed with gypsum panel products or lath and plaster shall be designed and constructed in accordance with Section 2306.3 and are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7.

2505.2 Resistance to shear (steel framing). Cold-formed steel-frame shear walls sheathed with gypsum panel products and constructed in accordance with the materials and provisions of Section 2206.1.1 are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7.

2505.3 [DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *Section 2505.1 and 2505.2 are not permitted.*

Exception: [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

SECTION 2506—GYPSUM PANEL PRODUCT MATERIALS

2506.1 General. Gypsum panel products and accessories shall be identified by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored to protect such materials from the weather.

2506.2 Standards. Gypsum panel products shall conform to the appropriate standards listed in Table 2506.2 and Chapter 35 and, where required for fire protection, shall conform to the provisions of Chapter 7.

TABLE 2506.2—GYPSUM PANEL PRODUCTS MATERIALS AND ACCESSORIES

MATERIAL	STANDARD
Accessories for gypsum board	ASTM C1047
Adhesives for fastening gypsum board to wood framing	ASTM C557
Cold-formed steel studs and track, structural	AISI S240
Cold-formed steel studs and track, nonstructural	AISI S220
Elastomeric joint sealants	ASTM C920
Expandable foam adhesives for fastening gypsum wallboard to wood framing	ASTM D6464

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TABLE 2506.2—GYPSUM PANEL PRODUCTS MATERIALS AND ACCESSORIES—continued	
MATERIAL	**STANDARD**
Factory-laminated gypsum panel product	ASTM C1766
Fiber-reinforced gypsum panels	ASTM C1278
Glass mat gypsum backing panel	ASTM C1178
Glass mat gypsum panels	ASTM C1658
Glass mat gypsum substrate used as sheathing	ASTM C1177
Joint reinforcing tape and compound	ASTM C474; C475
Nails for gypsum boards	ASTM C514, F547, F1667
Steel screws	ASTM C954; C1002
Standard specification for gypsum board	ASTM C1396
Testing gypsum and gypsum products	ASTM C22; C472; C473

2506.2.1 Other materials. Metal suspension systems for acoustical and lay-in panel ceilings shall comply with ASTM C635 listed in Chapter 35 and Section 13.5.6 of ASCE 7 for installation in high seismic areas.

SECTION 2507—LATHING AND PLASTERING

2507.1 General. Lathing and plastering materials and accessories shall be marked by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored in such a manner to protect them from the weather.

2507.2 Standards. Lathing and plastering materials shall conform to the standards listed in Table 2507.2 and Chapter 35 and, where required for fire protection, shall conform to the provisions of Chapter 7.

TABLE 2507.2—LATH, PLASTERING MATERIALS AND ACCESSORIES	
MATERIAL	**STANDARD**
Accessories for gypsum veneer base	ASTM C1047
Blended cement	ASTM C595
Cold-formed steel studs and track, structural	AISI S240
Cold-formed steel studs and track, nonstructural	AISI S220
Exterior plaster bonding compounds	ASTM C932
Hydraulic cement	ASTM C1157; C1600
Gypsum casting and molding plaster	ASTM C59
Gypsum Keene's cement	ASTM C61
Gypsum plaster	ASTM C28
Gypsum veneer plaster	ASTM C587
Interior bonding compounds, gypsum	ASTM C631
Lime plasters	ASTM C5; C206
Masonry cement	ASTM C91
Metal lath	ASTM C847
Plaster aggregates Sand Perlite Vermiculite	 ASTM C35; C897 ASTM C35 ASTM C35
Plastic cement	ASTM C1328
Portland cement	ASTM C150
Steel screws	ASTM C1002; C954
Welded wire lath	ASTM C933
Woven wire plaster base	ASTM C1032

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2507.3 Lath attachment to horizontal wood supports. [DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *Where interior or exterior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment described in referenced standards listed in Table 2507.2.*

1. *Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches (76 mm) back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist and the ends of the wire secured together with three twists of the wire.*
2. *Secure lath to each support with $^{1}/_{2}$-inch-wide (12.7 mm), $1^{1}/_{2}$-inch-long (38mm) No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches (76 mm) from edge of each sheet. Such staples may be placed over ribs of $^{3}/_{8}$-inch (9.5 mm) rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails. A minimum No. 8 wood screw in accordance with ANSI B18.6.1 with 1-inch minimum penetration into a wood joist shall be permitted to be used in lieu of the staples if they are installed with a 1-inch diameter washer.*

SECTION 2508—GYPSUM CONSTRUCTION

2508.1 General. Gypsum panel products and gypsum plaster construction shall be of the materials listed in Tables 2506.2 and 2507.2. These materials shall be assembled and installed in compliance with the appropriate standards listed in Tables 2508.1 and 2511.1.1 and Chapter 35.

TABLE 2508.1—INSTALLATION OF GYPSUM CONSTRUCTION

MATERIAL	STANDARD
Gypsum panel products	GA-216; ASTM C840
Gypsum sheathing and gypsum panel products	ASTM C1280; GA-253
Gypsum veneer base	ASTM C844
Interior lathing and furring	ASTM C841
Steel framing for gypsum panel products	ASTM C754; C1007

2508.2 Limitations. Gypsum wallboard or gypsum plaster shall not be used in any exterior surface where such gypsum construction will be exposed directly to the weather. Gypsum wallboard shall not be used where there will be direct exposure to water or continuous high humidity conditions. Gypsum sheathing shall be installed on exterior surfaces in accordance with ASTM C1280 or GA-253.

2508.2.1 Weather protection. Gypsum wallboard, gypsum lath or gypsum plaster shall not be installed until weather protection for the installation is provided.

2508.3 Single-ply application. Edges and ends of gypsum panel products shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Edges and ends of gypsum panel products shall be in moderate contact except in concealed spaces where fire-resistance-rated construction, shear resistance or diaphragm action is not required.

2508.3.1 Floating angles. Fasteners at the top and bottom plates of vertical assemblies, or the edges and ends of horizontal assemblies perpendicular to supports, and at the wall line are permitted to be omitted except on shear resisting elements or fire-resistance-rated assemblies. Fasteners shall be applied in such a manner as not to fracture the face paper with the fastener head.

2508.4 Adhesives. Gypsum panel products secured to framing with adhesives in ceiling assemblies shall be attached using an approved fastening schedule. Expandable foam adhesives for fastening gypsum wallboard shall conform to ASTM D6464. Other adhesives for the installation of gypsum wallboard shall conform to ASTM C557.

2508.5 Joint treatment. Gypsum panel product fire-resistance-rated assemblies shall have joints and fasteners treated.

Exceptions: Joint and fastener treatment need not be provided where any of the following conditions occur:

1. Where the gypsum panel product is to receive a decorative finish such as wood paneling, battens, acoustical finishes or any similar application that would be equivalent to joint treatment.
2. On single-layer systems where joints occur over wood framing members.
3. Square edge or tongue-and-groove edge gypsum board (V-edge), gypsum panel products, gypsum backing board or gypsum sheathing.
4. On multilayer systems where the joints of adjacent layers are offset.
5. Assemblies tested without joint treatment.

2508.6 Horizontal gypsum panel product diaphragm ceilings. Gypsum panel products shall be permitted to be used on wood joists to create a horizontal diaphragm ceiling in accordance with Table 2508.6.

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TABLE 2508.6—SHEAR CAPACITY FOR HORIZONTAL WOOD-FRAME GYPSUM PANEL PRODUCT DIAPHRAGM CEILING ASSEMBLIES				
MATERIAL	THICKNESS OF MATERIAL (MINIMUM) (inches)	SPACING OF FRAMING MEMBERS (inches)	SHEAR VALUE[a, b] (PLF OF CEILING)	MIMIMUM FASTENER SIZE
Gypsum panel product	$^1/_2$	16 o.c.	90	5d cooler or wallboard nail; $1^5/_8$-inch long; 0.086-inch shank; $^{15}/_{64}$-inch head[c]
Gypsum panel product	$^1/_2$	24 o.c.	70	5d cooler or wallboard nail; $1^5/_8$-inch long; 0.086-inch shank; $^{15}/_{64}$-inch head[c]

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.59 N/m.

a. Values are not cumulative with other horizontal diaphragm values and are for short-term wind or seismic loading. Values shall be reduced 25 percent for normal loading.

b. Values shall be reduced 50 percent in Seismic Design Categories D, E and F.

c. $1^1/_4$-inch, No. 6 Type S or W screws are permitted to be substituted for the listed nails.

2508.6.1 Diaphragm proportions. The maximum allowable diaphragm proportions shall be $1^1/_2$:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted.

2508.6.2 Installation. Gypsum panel products used in a horizontal diaphragm ceiling shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of gypsum board shall not occur on the same joist.

2508.6.3 Blocking of perimeter edges. Perimeter edges shall be blocked using a wood member not less than 2-inch by 6-inch (51 mm by 152 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum panel product.

2508.6.4 Fasteners. Fasteners used for the attachment of gypsum panel products to a horizontal diaphragm ceiling shall be as defined in Table 2508.6. Fasteners shall be spaced not more than 7 inches (178 mm) on center at all supports, including perimeter blocking, and not more than $^3/_8$ inch (9.5 mm) from the edges and ends of the gypsum panel product.

2508.6.5 Lateral force restrictions. Gypsum panel products shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction.

2508.6.6 Diaphragm ceiling connection to partitions. [DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] *Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by partitions. Connection of diaphragm ceiling to the vertical lateral force resisting elements shall be designed and detailed to transfer lateral forces.*

Exception: [OSHPD 2] *Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

SECTION 2509—SHOWERS AND WATER CLOSETS

2509.1 Wet areas. Showers and public toilet walls shall conform to Section 1210.2.

2509.2 Base for tile. Materials used as a base for wall tile in tub and shower areas and wall and ceiling panels in shower areas shall be of materials listed in Table 2509.2 and installed in accordance with the manufacturer's recommendations. Water-resistant gypsum backing board shall be used as a base for tile in water closet compartment walls when installed in accordance with GA-216 or ASTM C840 and the manufacturer's recommendations. Regular gypsum wallboard is permitted under tile or wall panels in other wall and ceiling areas when installed in accordance with GA 216 or ASTM C840.

TABLE 2509.2—BACKERBOARD MATERIALS	
MATERIAL	STANDARD
Glass mat gypsum backing panel	ASTM C1178
Nonasbestos fiber-cement backer board	ASTM C1288 or ISO 8336, Category C
Fiber-mat reinforced cementitious backer unit	ASTM C1325

2509.3 Limitations. Water-resistant gypsum backing board shall not be used in the following locations:

1. Over a vapor retarder in shower or bathtub compartments.
2. Where there will be direct exposure to water or in areas subject to continuous high humidity.

SECTION 2510—LATHING AND FURRING FOR CEMENT PLASTER (STUCCO)

2510.1 General. Exterior and interior cement plaster and lathing shall be done with the appropriate materials listed in Table 2507.2 and Chapter 35.

2510.2 Weather protection. Materials shall be stored in such a manner as to protect them from the weather.

2510.3 Installation. Installation of these materials shall be in compliance with ASTM C926 and ASTM C1063.

2510.4 Corrosion resistance. Metal lath and lath attachments shall be of corrosion-resistant material.

2510.5 Backing. Backing or a lath shall provide sufficient rigidity to permit plaster applications.

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2510.5.1 Support of lath. Where lath on vertical surfaces extends between rafters or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

2510.5.2 Use of gypsum backing board. Gypsum backing for cement plaster shall be in accordance with Section 2510.5.2.1 or 2510.5.2.2.

2510.5.2.1 Gypsum board as a backing board. Gypsum lath or gypsum wallboard shall not be used as a backing for cement plaster.

Exception: Gypsum lath or gypsum wallboard is permitted, with a water-resistive barrier, as a backing for self-furred metal lath or self-furred wire fabric lath and cement plaster where either of the following conditions occur:

1. On horizontal supports of ceilings or roof soffits.
2. On interior walls.

2510.5.2.2 Gypsum sheathing backing. Gypsum sheathing is permitted as a backing for metal or wire fabric lath and cement plaster on walls. A water-resistive barrier shall be provided in accordance with Section 2510.6.

2510.5.3 Backing not required. Wire backing is not required under expanded metal lath or paperbacked wire fabric lath.

[BF] 2510.6 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section 1403.2 and shall comply with Section 2510.6.1 or 2510.6.2.

Exception: Sections 2510.6.1 and 2510.6.2 shall not apply to construction where accumulation, condensation or freezing of moisture will not damage the materials.

[BF] 2510.6.1 Dry climates. One of the following shall apply for dry (B) climate zones:

1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of water-resistive barrier complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section 1404.4 and intended to drain to the water-resistive barrier, is directed between the layers.
2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other nonwater absorbing layer, or a drainage space or means of drainage complying with Section 2510.6.2. Flashing installed in accordance with Section 1404.4 and intended to drain to the water-resistive barrier shall be directed to the exterior side of the water-resistive barrier.

[BF] 2510.6.2 Moist or marine climates. In moist (A) or marine (C) climate zones, water-resistive barrier shall comply with one of the following:

1. In addition to complying with Item 1 or 2 of Section 2510.6.1, a space or drainage material not less than $^{3}/_{16}$ inch (4.8 mm) in depth shall be applied to the exterior side of the water-resistive barrier.
2. In addition to complying with Item 2 of Section 2510.6.1, drainage on the exterior side of the water-resistive barrier shall have a minimum drainage efficiency of 90 percent as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925.

2510.6.3 California Energy Code and International Energy Conservation Code Climate Zones. *The IECC climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Chapter 12, Table 1202.3.1.*

2510.7 Preparation of masonry and concrete. Surfaces shall be clean, free from efflorescence, sufficiently damp and rough for proper bond. If the surface is insufficiently rough, approved bonding agents or a Portland cement dash bond coat mixed in proportions of not more than two parts volume of sand to one part volume of Portland cement or plastic cement shall be applied. The dash bond coat shall be left undisturbed and shall be moist cured not less than 24 hours.

SECTION 2511—INTERIOR PLASTER

2511.1 General. Plastering gypsum plaster or cement plaster shall be not less than three coats where applied over metal lath or wire fabric lath and not less than two coats where applied over other bases permitted by this chapter.

Exception: Gypsum veneer plaster and cement plaster specifically designed and approved for one-coat applications.

2511.1.1 Installation. Installation of lathing and plaster materials shall conform to Table 2511.1.1 and Section 2507.

TABLE 2511.1.1—INSTALLATION OF PLASTER CONSTRUCTION

MATERIAL	STANDARD
Cement plaster	ASTM C926
Gypsum plaster	ASTM C842
Gypsum veneer plaster	ASTM C843
Interior lathing and furring (gypsum plaster)	ASTM C841
Lathing and furring (cement plaster)	ASTM C1063
Steel framing	ASTM C754; C1007

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2511.2 Limitations. Plaster shall not be applied directly to fiber insulation board. Cement plaster shall not be applied directly to gypsum lath or gypsum plaster except as specified in Sections 2510.5.1 and 2510.5.2.

2511.3 Grounds. Where installed, grounds shall ensure the minimum thickness of plaster as set forth in ASTM C842 and ASTM C926. Plaster thickness shall be measured from the face of lath and other bases.

2511.4 Interior masonry or concrete. Condition of surfaces shall be as specified in Section 2510.7. Approved specially prepared gypsum plaster designed for application to concrete surfaces or approved acoustical plaster is permitted. The total thickness of base coat plaster applied to concrete ceilings shall be as set forth in ASTM C842 or ASTM C926. Should ceiling surfaces require more than the maximum thickness permitted in ASTM C842 or ASTM C926, metal lath or wire fabric lath shall be installed on such surfaces before plastering.

2511.5 Wet areas. Showers and public toilet walls shall conform to Sections 1210.2 and 1210.3. Where wood frame walls and partitions are covered on the interior with cement plaster or tile of similar material and are subject to water splash, the framing shall be protected with an approved moisture barrier.

SECTION 2512—EXTERIOR PLASTER

2512.1 General. Plastering with cement plaster shall be not less than three coats where applied over metal lath or wire fabric lath or gypsum board backing as specified in Section 2510.5 and shall be not less than two coats where applied over masonry or concrete. If the plaster surface is to be completely covered by veneer or other facing material, or is completely concealed by another wall, plaster application need only be two coats, provided that the total thickness is as set forth in ASTM C926.

2512.1.1 On-grade floor slab. On wood frame or steel stud construction with an on-grade concrete floor slab system, exterior plaster shall be applied in such a manner as to cover, but not to extend below, the lath and paper. The application of lath, paper and flashing or drip screeds shall comply with ASTM C1063.

2512.1.2 Weep screeds. A minimum 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed with a minimum vertical attachment flange of $3^1/_2$ inches (89 mm) shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C926. The weep screed shall be placed not less than 4 inches (102 mm) above the earth or 2 inches (51 mm) above paved areas and be of a type that will allow trapped water to drain to the exterior of the building. The water-resistive barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

2512.2 Plasticity agents. Only approved plasticity agents and approved amounts thereof shall be added to Portland cement or blended cements. Where plastic cement or masonry cement is used, additional lime or plasticizers shall not be added. Hydrated lime or the equivalent amount of lime putty used as a plasticizer is permitted to be added to cement plaster or cement and lime plaster in an amount not to exceed that set forth in ASTM C926.

2512.3 Limitations. Gypsum plaster shall not be used on exterior surfaces.

2512.4 Cement plaster. Plaster coats shall be protected from freezing for a period of not less than 24 hours after set has occurred. Plaster shall be applied when the ambient temperature is higher than 40°F (4°C), unless provisions are made to keep cement plaster work above 40°F (4°C) during application and 48 hours thereafter.

2512.5 Second-coat application. The second coat shall be brought out to proper thickness, rodded and floated sufficiently rough to provide adequate bond for the finish coat. The second coat shall not have variations greater than $^1/_4$ inch (6.4 mm) in any direction under a 5-foot (1524 mm) straight edge.

2512.6 Curing and interval. First and second coats of cement plaster shall be applied and moist cured as set forth in ASTM C926 and Table 2512.6.

TABLE 2512.6—CEMENT PLASTERS

COAT	MINIMUM PERIOD MOIST CURING	MINIMUM INTERVAL BETWEEN COATS
First	48 hours[a]	48 hours[b]
Second	48 hours	7 days[c]
Finish	—	Note c

a. The first two coats shall be as required for the first coats of exterior plaster, except that the moist-curing time period between the first and second coats shall be not less than 24 hours. Moist curing shall not be required where job and weather conditions are favorable to the retention of moisture in the cement plaster for the required time period.
b. Twenty-four-hour minimum interval between coats of interior cement plaster. For alternative method of application, see Section 2512.8.
c. Finish coat plaster is permitted to be applied to interior cement plaster base coats after a 48-hour period.

2512.7 Application to solid backings. Where applied over gypsum backing as specified in Section 2510.5 or directly to unit masonry surfaces, the second coat is permitted to be applied as soon as the first coat has attained sufficient hardness.

2512.8 Alternate method of application. The second coat is permitted to be applied as soon as the first coat has attained sufficient rigidity to receive the second coat.

2512.8.1 Admixtures. Where using this method of application, calcium aluminate cement up to 15 percent of the weight of the Portland cement is permitted to be added to the mix.

2512.8.2 Curing. Curing of the first coat is permitted to be omitted and the second coat shall be cured as set forth in ASTM C926 and Table 2512.6.

2512.9 Finish coats. Cement plaster finish coats shall be applied over base coats that have been in place for the time periods set forth in ASTM C926. The third or finish coat shall be applied with sufficient material and pressure to bond and to cover the brown coat and shall be of sufficient thickness to conceal the brown coat.

SECTION 2513—EXPOSED AGGREGATE PLASTER

2513.1 General. Exposed natural or integrally colored aggregate is permitted to be partially embedded in a natural or colored bedding coat of cement plaster or gypsum plaster, subject to the provisions of this section.

2513.2 Aggregate. The aggregate shall be applied manually or mechanically and shall consist of marble chips, pebbles or similar durable, moderately hard (three or more on the Mohs hardness scale), nonreactive materials.

2513.3 Bedding coat proportions. The bedding coat for interior or exterior surfaces shall be composed of one part Portland cement and one part Type S lime; or one part blended cement and one part Type S lime; or masonry cement; or plastic cement and not more than three parts of graded white or natural sand by volume. The bedding coat for interior surfaces shall be composed of 100 pounds (45.4 kg) of neat gypsum plaster and not more than 200 pounds (90.8 kg) of graded white sand. A factory-prepared bedding coat for interior or exterior use is permitted. The bedding coat for exterior surfaces shall have a minimum compressive strength of 1,000 pounds per square inch (6895 kPa).

2513.4 Application. The bedding coat is permitted to be applied directly over the first (scratch) coat of plaster, provided that the ultimate overall thickness is not less than $^{7}/_{8}$ inch (22 mm), including lath. Over concrete or masonry surfaces, the overall thickness shall be not less than $^{1}/_{2}$ inch (12.7 mm).

2513.5 Bases. Exposed aggregate plaster is permitted to be applied over concrete, masonry, cement plaster base coats or gypsum plaster base coats installed in accordance with Section 2511 or 2512.

2513.6 Preparation of masonry and concrete. Masonry and concrete surfaces shall be prepared in accordance with the provisions of Section 2510.7.

2513.7 Curing of base coats. Cement plaster base coats shall be cured in accordance with ASTM C926. Cement plaster bedding coats shall retain sufficient moisture for hydration (hardening) for 24 hours minimum or, where necessary, shall be kept damp for 24 hours by light water spraying.

SECTION 2514—REINFORCED GYPSUM CONCRETE

2514.1 General. Reinforced gypsum concrete shall comply with the requirements of ASTM C317 and ASTM C956.

Exception: [DSA-SS and OSHPD 1, 1R, 2, 4 & 5] *Reinforced gypsum concrete shall be considered as an alternative system, except for* ***[OSHPD 2]*** *single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.*

2514.2 Minimum thickness. The minimum thickness of reinforced gypsum concrete shall be 2 inches (51 mm) except the minimum required thickness shall be reduced to $1^{1}/_{2}$ inches (38 mm), provided that the following conditions are satisfied:

1. The overall thickness, including the formboard, is not less than 2 inches (51 mm).
2. The clear span of the gypsum concrete between supports does not exceed 33 inches (838 mm).
3. Diaphragm action is not required.
4. The design live load does not exceed 40 pounds per square foot (psf) (1915 Pa).

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 26 – PLASTIC

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X		X	X	X			X	X	X	X	X	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

26 PLASTIC

User notes:

About this chapter: The use of plastics in building construction and components is addressed in Chapter 26. This chapter provides standards addressing foam plastic insulation, foam plastics used as interior finish and trim, and other plastic veneers used on the inside or outside of a building. This chapter addresses the use of light-transmitting plastics in various configurations such as walls, roof panels, skylights, signs and glazing. Requirements for the use of fiber-reinforced polymers, fiberglass-reinforced polymers and reflective plastic core insulation are also contained in this chapter. Additionally, requirements specific to the use of wood-plastic composites and plastic lumber are contained in this chapter.

SECTION 2601—GENERAL

2601.1 Scope. These provisions shall govern the materials, design, application, construction and installation of foam plastic, foam plastic insulation, plastic veneer, interior plastic finish and trim, light-transmitting plastics and plastic composites, including plastic lumber.

SECTION 2602—FINISH AND TRIM

2602.1 Exterior wall covering and architectural trim. See Chapter 14 for requirements for exterior wall covering and architectural trim.

2602.2 Interior finish and trim. See Section 2604 for requirements for interior finish and trim.

SECTION 2603—FOAM PLASTIC INSULATION

2603.1 General. The provisions of this section shall govern the requirements and uses of foam plastic insulation in buildings and structures.

2603.1.1 Spray-applied foam plastic. Single- and multiple-component spray-applied foam plastic insulation shall comply with the provisions of Section 2603 and ICC 1100.

2603.1.2 Insulating sheathing. Foam plastic materials used as insulating sheathing shall comply with the provisions of Section 2603 and the material standards in Table 2603.1.2.

TABLE 2603.1.2—MATERIAL STANDARDS FOR FOAM PLASTIC INSULATING SHEATHING

MATERIAL	STANDARD
Expanded Polystyrene (EPS)	ASTM C578
Extruded Polystyrene (XPS)	ASTM C578
Polyisocyanurate	ASTM C1289

2603.2 Labeling and identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

***2603.2.1 Labeling of polystyrene foam insulation without flame retardants**. In addition to the requirements of Section 2603.2, polystyrene foam insulation boards manufactured with no flame retardants added shall be labeled in accordance with this section.*

1. *Each board shall be labeled on each face every 8 square feet in red $^1/_2$-inch text with the following information:*

   WARNING - FIRE HAZARD

   This product is required to be installed below a minimum 3.5-inch-thick concrete slab on grade.

   NOT FOR VERTICAL OR ABOVE-GRADE APPLICATIONS

   This product contains NO flame retardants.

   Not tested for flame spread or smoke development requirements of the model building codes
2. *Each package shall be labeled on at least two sides in red $^1/_2$-text with the following information:*

   WARNING – COMBUSTIBLE MATERIAL

   Keep away from ignition sources.

   Maintain code required separation between product storage and structures under construction (minimum 30 feet).

2603.3 Surface-burning characteristics. Unless otherwise indicated in this section, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E84 or UL 723. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread and smoke-developed indices.

Exceptions:

1. Smoke-developed index for interior trim as provided for in Section 2604.2.

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2. In cold storage buildings, ice plants, food plants, food processing rooms and similar areas, foam plastic insulation where tested in a thickness of 4 inches (102 mm) shall be permitted in a thickness up to 10 inches (254 mm) where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. The approved automatic sprinkler system shall be provided in both the room and that part of the building in which the room is located.
3. Foam plastic insulation that is a part of a Class A, B or C roof-covering assembly provided that the assembly with the foam plastic insulation satisfactorily passes NFPA 276 or UL 1256. The smoke-developed index shall not be limited for roof applications.
4. Foam plastic insulation greater than 4 inches (102 mm) in thickness shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided that the end use is approved in accordance with Section 2603.9 using the maximum thickness and density intended for use.
5. Flame spread and smoke-developed indices for foam plastic interior signs in covered and open mall buildings provided that the signs comply with Section 402.6.4.
6. *Polystyrene foam insulation boards with a maximum thickness of 2 inches when installed below a minimum 3.5-inch-thick concrete slab on grade.*

2603.4 Thermal barrier. Except as provided for in Sections 2603.4.1 and 2603.9, foam plastic shall be separated from the interior of a building by an approved thermal barrier of $^1/_2$-inch (12.7 mm) gypsum wallboard, mass timber or heavy timber in accordance with Section 2304.11 or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275. Combustible concealed spaces shall comply with Section 718.

2603.4.1 Thermal barrier not required. The thermal barrier specified in Section 2603.4 is not required under the conditions set forth in Sections 2603.4.1.1 through 2603.4.1.15.

2603.4.1.1 Masonry or concrete construction. A thermal barrier is not required for foam plastic installed in a masonry or concrete wall, floor or roof system where the foam plastic insulation is covered on each face by not less than 1-inch (25 mm) thickness of masonry or concrete.

2603.4.1.2 Cooler and freezer walls. Foam plastic installed in a maximum thickness of 10 inches (254 mm) in cooler and freezer walls shall:

1. Have a flame spread index of 25 or less and a smoke-developed index of not more than 450, where tested in a minimum 4-inch (102 mm) thickness.
2. Have flash ignition and self-ignition temperatures of not less than 600°F and 800°F (316°C and 427°C), respectively.
3. Have a covering of not less than 0.032-inch (0.8 mm) aluminum or corrosion-resistant steel having a base metal thickness not less than 0.0160 inch (0.4 mm) at any point.
4. Be protected by an automatic sprinkler system in accordance with Section 903.3.1.1. Where the cooler or freezer is within a building, both the cooler or freezer and that part of the building in which it is located shall be sprinklered.

2603.4.1.3 Walk-in coolers. In nonsprinklered buildings, foam plastic having a thickness that does not exceed 4 inches (102 mm) and a maximum flame spread index of 75 is permitted in walk-in coolers or freezer units where the aggregate floor area does not exceed 400 square feet (37 m^2) and the foam plastic is covered by a metal facing not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). A thickness of up to 10 inches (254 mm) is permitted where protected by a thermal barrier.

2603.4.1.4 Exterior walls, one-story buildings. For exterior walls of one-story buildings constructed of insulated metal panels (IMP) with foam plastic insulation cores, the thermal barrier is not required when all of the following apply:

1. The foam plastic insulation thickness is not more than 4 inches (102 mm).
2. The foam plastic insulation core has a flame spread index of 25 or less and a smoke-developed index of 450 or less.
3. The foam plastic insulation is covered by not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.41 mm).
4. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2603.4.1.5 Roofing. A thermal barrier is not required for foam plastic insulation that is a part of a Class A, B or C roof-covering assembly that is installed in accordance with the code and the manufacturer's instructions and is either constructed as described in Item 1 or tested as described in Item 2.

1. The roof assembly is separated from the interior of the building by wood structural panel sheathing not less than 0.47 inch (11.9 mm) in thickness bonded with exterior glue, with edges supported by blocking, tongue-and-groove joints, other approved type of edge support or an equivalent material.
2. The assembly with the foam plastic insulation satisfactorily passes NFPA 276 or UL 1256.

2603.4.1.6 Attics and crawl spaces. Within an attic or crawl space where entry is made only for service of utilities, foam plastic insulation shall be protected against ignition by $1^1/_2$-inch-thick (38 mm) mineral fiber insulation; $^1/_4$-inch-thick (6.4 mm) wood structural panel, particleboard or hardboard; $^3/_8$-inch (9.5 mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4 mm); $1^1/_2$-inch-thick (38 mm) self-supported spray-applied cellulose insulation in attic spaces only or other approved material installed in such a manner that the foam plastic insulation is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

2603.4.1.7 Doors not required to have a fire protection rating. Where pivoted or side-hinged doors are permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of aluminum not less than 0.032 inch (0.8 mm) in thickness or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

2603.4.1.8 Exterior doors in buildings of Group R-2 or R-3. In occupancies classified as Group R-2 or R-3, foam-filled exterior entrance doors to individual dwelling units that do not require a fire-resistance rating shall be faced with aluminum, steel, fiberglass, wood or other approved materials.

2603.4.1.9 Garage doors. Where garage doors are permitted without a fire-resistance rating and foam plastic is used as a core material, the door facing shall be metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or 0.010-inch (0.25 mm) steel or the facing shall be minimum 0.125-inch-thick (3.2 mm) wood. Garage doors having facings other than those described in this section shall be tested in accordance with, and meet the acceptance criteria of, DASMA 107.

Exception: Garage doors using foam plastic insulation complying with Section 2603.3 in detached and attached garages associated with one- and two-family dwellings need not be provided with a thermal barrier.

2603.4.1.10 Siding backer board. Foam plastic insulation of not more than 2,000 British thermal units per square feet (Btu/sq. ft.) (22.7 mJ/m^2) as determined by NFPA 259 shall be permitted as a siding backer board with a maximum thickness of $^1/_2$ inch (12.7 mm), provided that it is separated from the interior of the building by not less than 2 inches (51 mm) of mineral fiber insulation or equivalent or where applied as insulation with re-siding over existing wall construction.

2603.4.1.11 Interior trim. Foam plastic used as interior trim in accordance with Section 2604 shall be permitted without a thermal barrier.

2603.4.1.12 Interior signs. Foam plastic used for interior signs in covered mall buildings in accordance with Section 402.6.4 shall be permitted without a thermal barrier. Foam plastic signs that are not affixed to interior building surfaces shall comply with Chapter 8 of the *California Fire Code.*

2603.4.1.13 Type V construction. Foam plastic spray applied to a sill plate, joist header and rim joist in Type V construction is subject to all of the following:

1. The maximum thickness of the foam plastic shall be $3^1/_4$ inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m^3).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723.

2603.4.1.14 Floors. The thermal barrier specified in Section 2603.4 is not required to be installed on the walking surface of a structural floor system that contains foam plastic insulation where the foam plastic is covered by a minimum nominal $^1/_2$-inch-thick (12.7 mm) wood structural panel or approved equivalent. The thermal barrier specified in Section 2603.4 is required on the underside of the structural floor system that contains foam plastic insulation where the underside of the structural floor system is exposed to the interior of the building.

Exception: Foam plastic used as part of an interior floor finish.

2603.4.1.15 Separately controlled climate structures. In nonsprinklered buildings of Group U, foam plastic having a thickness that does not exceed 4 inches (102 mm) and a maximum flame spread index of 75 is permitted in separately controlled climate structures where the aggregate floor area does not exceed 400 square feet (37 m^2) and the foam plastic is covered by a metal facing not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41mm). A thickness of up to 10 inches (254 mm) is permitted where protected by a thermal barrier.

2603.5 Exterior walls of buildings of any height. Exterior walls of buildings of Type I, II, III or IV construction of any height shall comply with Sections 2603.5.1 through 2603.5.7. Exterior walls of cold storage buildings required to be constructed of noncombustible materials, where the building is more than one story in height, shall comply with the provisions of Sections 2603.5.1 through 2603.5.7. Exterior walls of buildings of Type V construction shall comply with Sections 2603.2, 2603.3 and 2603.4. Fireblocking shall be in accordance with Section 718.2.

2603.5.1 Fire-resistance-rated walls. Where the wall is required to have a fire-resistance rating, data based on tests conducted in accordance with ASTM E119 or UL 263 shall be provided to substantiate that the fire-resistance rating is maintained.

2603.5.2 Thermal barrier. Any foam plastic insulation shall be separated from the building interior by a thermal barrier meeting the provisions of Section 2603.4, unless special approval is obtained on the basis of Section 2603.9.

Exception: One-story buildings complying with Section 2603.4.1.4.

2603.5.3 Potential heat. The potential heat of foam plastic insulation in any portion of the wall or panel shall not exceed the potential heat expressed in Btu per square feet (mJ/m^2) of the foam plastic insulation contained in the wall assembly tested in accordance with Section 2603.5.5. The potential heat of the foam plastic insulation shall be determined by tests conducted in accordance with NFPA 259 and the results shall be expressed in Btu per square feet (mJ/m^2).

Exception: One-story buildings complying with Section 2603.4.1.4.

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2603.5.4 Flame spread and smoke-developed indices. Foam plastic insulation, exterior coatings and facings shall be tested separately in the thickness intended for use, but not to exceed 4 inches (102 mm), and shall each have a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723.

Exception: Prefabricated or factory-manufactured panels having minimum 0.020-inch (0.51 mm) aluminum facings and a total thickness of $^1/_4$ inch (6.4 mm) or less are permitted to be tested as an assembly where the foam plastic core is not exposed in the course of construction.

2603.5.5 Vertical and lateral fire propagation. The exterior wall assembly shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

Exceptions:

1. One-story buildings complying with Section 2603.4.1.4.
2. Exterior wall assemblies where the foam plastic insulation is covered on each face by not less than 1-inch (25 mm) thickness of masonry or concrete and meeting one of the following:
   2.1. There is no airspace between the insulation and the concrete or masonry.
   2.2. The insulation has a flame spread index of not more than 25 as determined in accordance with ASTM E84 or UL 723 and the maximum airspace between the insulation and the concrete or masonry is not more than 1 inch (25 mm).

2603.5.6 Label required. The edge or face of each piece, package or container of foam plastic insulation shall bear the label of an approved agency. The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or materials' performance characteristics and approved agency's identification.

2603.5.7 Ignition. Exterior walls shall not exhibit sustained flaming where tested in accordance with NFPA 268. Where a material is intended to be installed in more than one thickness, tests of the minimum and maximum thickness intended for use shall be performed.

Exception: Assemblies protected on the outside with one of the following:

1. A thermal barrier complying with Section 2603.4.
2. A minimum 1-inch (25 mm) thickness of concrete or masonry.
3. Glass-fiber-reinforced concrete panels of a minimum thickness of $^3/_8$ inch (9.5 mm).
4. Metal-faced panels having minimum 0.019-inch-thick (0.48 mm) aluminum or 0.016-inch-thick (0.41 mm) corrosion-resistant steel outer facings.
5. A minimum $^7/_8$-inch (22.2 mm) thickness of stucco complying with Section 2510.
6. A minimum $^1/_4$-inch (6.4 mm) thickness of fiber-cement lap, panel or shingle siding complying with Section 1404.17 and Section 1404.17.1 or 1404.17.2.

2603.6 Roofing. Foam plastic insulation meeting the requirements of Sections 2603.2, 2603.3 and 2603.4 shall be permitted as part of a roof-covering assembly, provided that the assembly with the foam plastic insulation is a Class A, B or C roofing assembly where tested in accordance with ASTM E108 or UL 790.

2603.7 Foam plastic in plenums as interior finish or interior trim. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, and shall be tested in accordance with NFPA 286 and meet the acceptance criteria of Section 803.1.1. As an alternative to testing to NFPA 286, the foam plastic shall be approved based on tests conducted in accordance with Section 2603.9.

Exceptions:

1. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by a thermal barrier complying with Section 2603.4.
2. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by corrosion-resistant steel having a base metal thickness of not less than 0.0160 inch (0.4 mm).
3. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by not less than a 1-inch (25 mm) thickness of masonry or concrete.

2603.8 Protection against termites. In areas where the probability of termite infestation is very heavy in accordance with Figure 2603.8, extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be not less than 6 inches (152 mm).

Exceptions:

1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or preservative-treated wood.

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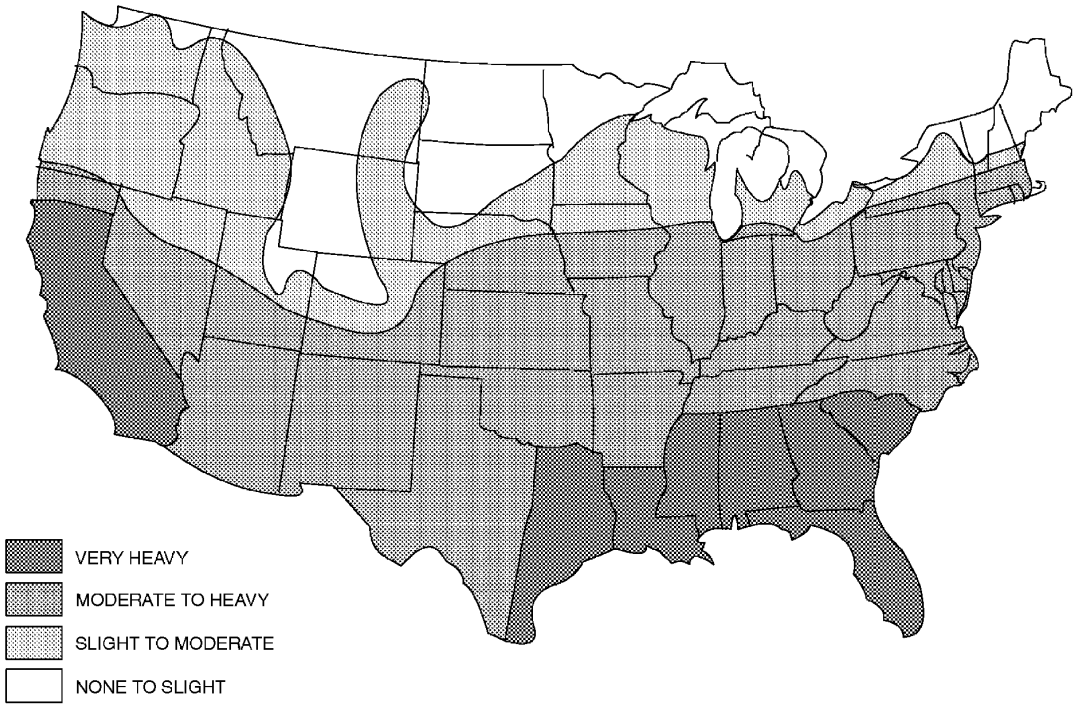
2. An approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
3. On the interior side of basement walls.

FIGURE 2603.8—TERMITE INFESTATION PROBABILITY MAP



2603.9 Special approval. Foam plastic shall not be required to comply with the requirements of Section 2603.4 or those of Section 2603.6 where specifically approved based on one of the following large-scale tests:

1. NFPA 286 using the acceptance criteria of Section 803.1.1.1.
2. FM 4880.
3. UL 1040.
4. UL 1715.

Such testing shall be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of these tests shall also conform to the flame spread and smoke-developed requirements of Chapter 8. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

[BS] 2603.10 Wind resistance. Foam plastic insulation complying with ASTM C578 and ASTM C1289 and used as exterior wall sheathing on framed wall assemblies shall comply with ANSI/SBCA FS 100 for wind pressure resistance.

*

SECTION 2604—INTERIOR FINISH AND TRIM

2604.1 General. Plastic materials installed as interior finish or trim shall comply with Chapter 8. Foam plastics shall only be installed as interior finish where approved in accordance with the special provisions of Section 2603.9. Foam plastics that are used as interior finish shall meet the flame spread and smoke-developed index requirements for interior finish in accordance with Chapter 8. Foam plastics installed as interior trim shall comply with Section 2604.2.

2604.1.1 Plenums. Foam plastics installed in plenums as interior wall or ceiling finish shall comply with Section 2603.7. Foam plastics installed in plenums as interior trim shall comply with Sections 2604.2 and 2603.7.

[F] 2604.2 Interior trim. Foam plastic used as interior trim shall comply with Sections 2604.2.1 through 2604.2.4.

[F] 2604.2.1 Density. The minimum density of the interior trim shall be 20 pcf (320 kg/m^3).

[F] 2604.2.2 Thickness. The maximum thickness of the interior trim shall be $^1/_2$ inch (12.7 mm) and the maximum width shall be 8 inches (204 mm).

[F] 2604.2.3 Area limitation. The interior trim shall not constitute more than 10 percent of the specific wall or ceiling areas to which it is attached.

[F] 2604.2.4 Flame spread. The flame spread index shall not exceed 75 where tested in accordance with ASTM E84 or UL 723. The smoke-developed index shall not be limited.

Exception: Where the interior trim material has been tested as an interior finish in accordance with NFPA 286 and complies with the acceptance criteria in Section 803.1.1.1, it shall not be required to be tested for flame spread index in accordance with ASTM E84 or UL 723.

SECTION 2605—PLASTIC VENEER

2605.1 Interior use. Where used within a building, plastic veneer shall comply with the interior finish requirements of Chapter 8.

2605.2 Exterior use. Exterior plastic veneer, other than plastic siding, shall be permitted to be installed on the exterior walls of buildings of any type of construction in accordance with all of the following requirements:

1. Plastic veneer shall comply with Section 2606.4.
2. Plastic veneer shall not be attached to any exterior wall to a height greater than 50 feet (15 240 mm) above grade.
3. Sections of plastic veneer shall not exceed 300 square feet (27.9 m^2) in area and shall be separated by not less than 4 feet (1219 mm) vertically.

Exception: The area and separation requirements and the smoke-density limitation are not applicable to plastic veneer applied to buildings constructed of Type VB construction, provided that the walls are not required to have a fire-resistance rating.

2605.3 Plastic siding. Plastic siding shall comply with the requirements of Sections 1403 and 1404.

SECTION 2606—LIGHT-TRANSMITTING PLASTICS

2606.1 General. The provisions of this section and Sections 2607 through 2611 shall govern the quality and methods of application of light-transmitting plastics for use as light-transmitting materials in buildings and structures. Foam plastics shall comply with Section 2603. Light-transmitting plastic materials that meet the other code requirements for walls and roofs shall be permitted to be used in accordance with the other applicable chapters of the code.

2606.2 Approval for use. Sufficient technical data shall be submitted to substantiate the proposed use of any light-transmitting material, as approved by the building official and subject to the requirements of this section.

2606.3 Identification. Each unit or package of light-transmitting plastic shall be identified with a mark or decal satisfactory to the building official, which includes identification as to the material classification.

2606.4 Specifications. Light-transmitting plastics, including thermoplastic, thermosetting or reinforced thermosetting plastic material, shall have a self-ignition temperature of 650°F (343°C) or greater where tested in accordance with ASTM D1929; a smoke-developed index not greater than 450 where tested in the manner intended for use in accordance with ASTM E84 or UL 723, or a maximum average smoke density rating not greater than 75 where tested in the thickness intended for use in accordance with ASTM D2843 and shall conform to one of the following combustibility classifications:

Class CC1: Plastic materials that have a burning extent of 1 inch (25 mm) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D635.

Class CC2: Plastic materials that have a burning rate of $2^1/_2$ inches per minute (1.06 mm/s) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D635.

[BS] 2606.5 Structural requirements. Light-transmitting plastic materials in their assembly shall be of adequate strength and durability to withstand the loads indicated in Chapter 16. Technical data shall be submitted to establish stresses, maximum unsupported spans and such other information for the various thicknesses and forms used as deemed necessary by the building official.

[BS] 2606.6 Fastening. Fastening shall be adequate to withstand the loads in Chapter 16. Proper allowance shall be made for expansion and contraction of light-transmitting plastic materials in accordance with accepted data on the coefficient of expansion of the material and other material in conjunction with which it is employed.

2606.7 Light-diffusing systems. Unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, light-diffusing systems shall not be installed in the following occupancies and locations:

1. Group A with an occupant load of 1,000 or more.
2. Theaters with a stage and proscenium opening and an occupant load of 700 or more.
3. Group I-2.
4. Group I-3.
5. Interior exit stairways and ramps and exit passageways.

2606.7.1 Support. Light-transmitting plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of noncombustible hangers. Hangers shall be not less than No. 12 steel-wire gage (0.106 inch) galvanized wire or equivalent.

2606.7.2 Installation. Light-transmitting plastic diffusers shall comply with Chapter 8 unless the light-transmitting plastic diffusers will fall from the mountings before igniting, at an ambient temperature of not less than 200°F (111°C) below the ignition temperature of the panels. The panels shall remain in place at an ambient room temperature of 175°F (79°C) for a period of not less than 15 minutes.

2606.7.3 Size limitations. Individual panels or units shall not exceed 10 feet (3048 mm) in length nor 30 square feet (2.79 m^2) in area.

2606.7.4 Automatic sprinkler system. In buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, plastic light-diffusing systems shall be protected both above and below unless the sprinkler system has been specifically approved for installation only above the light-diffusing system, or the light-diffusing system is listed and labeled in accordance with UL 723S. Areas of light-diffusing systems that are protected in accordance with this section shall not be limited.

2606.7.5 Electrical luminaires. Light-transmitting plastic panels and light-diffuser panels that are installed in approved electrical luminaires shall comply with the requirements of Chapter 8 unless the light-transmitting plastic panels conform to the requirements of Section 2606.7.2. The area of approved light-transmitting plastic materials that is used in required exits or corri-

dors shall not exceed 30 percent of the aggregate area of the ceiling in which such panels are installed, unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2606.8 Partitions. Light-transmitting plastics used in or as partitions shall comply with the requirements of Chapters 6 and 8.

2606.9 Bathroom accessories. Light-transmitting plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures and similar accessory units. Safety glazing shall be provided in accordance with Chapter 24.

2606.10 Awnings, patio covers and similar structures. Awnings constructed of light-transmitting plastics shall be constructed in accordance with the provisions specified in Section 3105 and Chapter 32 for projections. Patio covers constructed of light-transmitting plastics shall comply with Section 2606. Light-transmitting plastics used in canopies at motor fuel-dispensing facilities shall comply with Section 2606, except as modified by Section 406.7.2.

2606.11 Greenhouses. Light-transmitting plastics shall be permitted in lieu of glass in greenhouses.

2606.12 Solar collectors. Light-transmitting plastic covers on solar collectors having noncombustible sides and bottoms shall be permitted on buildings not over three stories above grade plane or 9,000 square feet (836.1 m^2) in total floor area, provided that the light-transmitting plastic cover does not exceed 33.33 percent of the roof area for CC1 materials or 25 percent of the roof area for CC2 materials.

Exception: Light-transmitting plastic covers having a thickness of 0.010 inch (0.3 mm) or less shall be permitted to be of any plastic material provided that the area of the solar collectors does not exceed 33.33 percent of the roof area.

SECTION 2607—LIGHT-TRANSMITTING PLASTIC WALL PANELS

2607.1 General. Light-transmitting plastics shall not be used as wall panels in exterior walls in occupancies in Groups A-l, A-2, H, I-2 and I-3. In other groups, light-transmitting plastics shall be permitted to be used as wall panels in exterior walls, provided that the walls are not required to have a fire-resistance rating and the installation conforms to the requirements of this section. Such panels shall be erected and anchored on a foundation, waterproofed or otherwise protected from moisture absorption and sealed with a coat of mastic or other approved waterproof coating. Light-transmitting plastic wall panels shall comply with Section 2606.

2607.2 Installation. Exterior wall panels installed as provided for herein shall not alter the type of construction classification of the building.

2607.3 Height limitation. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade plane.

2607.4 Area limitation and separation. The maximum area of a single wall panel and minimum vertical and horizontal separation requirements for exterior light-transmitting plastic wall panels shall be as provided for in Table 2607.4. The maximum percentage of wall area of any story in light-transmitting plastic wall panels shall not exceed that indicated in Table 2607.4 or the percentage of unprotected openings permitted by Section 705.9, whichever is smaller.

Exceptions:

1. In structures provided with approved flame barriers extending 30 inches (760 mm) beyond the exterior wall in the plane of the floor, a vertical separation is not required at the floor except that provided by the vertical thickness of the flame barrier projection.
2. Veneers of approved weather-resistant light-transmitting plastics used as exterior siding in buildings of Type V construction in compliance with Section 1405.
3. The area of light-transmitting plastic wall panels in exterior walls of greenhouses shall be exempt from the area limitations of Table 2607.4 but shall be limited as required for unprotected openings in accordance with Section 705.9.

TABLE 2607.4—AREA LIMITATION AND SEPARATION REQUIREMENTS FOR LIGHT-TRANSMITTING PLASTIC WALL PANELS[a]

FIRE SEPARATION DISTANCE (feet)	CLASS OF PLASTIC	MAXIMUM PERCENTAGE AREA OF EXTERIOR WALL IN PLASTIC WALL PANELS	MAXIMUM SINGLE AREA OF PLASTIC WALL PANELS (square feet)	MINIMUM SEPARATION OF PLASTIC WALL PANELS (feet)	
				Vertical	Horizontal
Less than 6	—	Not Permitted	Not Permitted	—	—
6 or more but less than 11	CC1	10	50	8	4
	CC2	Not Permitted	Not Permitted	—	—
11 or more but less than or equal to 30	CC1	25	90	6	4
	CC2	15	70	8	4
Over 30	CC1	50	Not Limited	3[b]	0
	CC2	50	100	6[b]	3

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. For combinations of plastic glazing and plastic wall panel areas permitted, see Section 2607.6.

b. For reductions in vertical separation allowed, see Section 2607.4.

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2607.5 Automatic sprinkler system. Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum percentage area of exterior wall in any story in light-transmitting plastic wall panels and the maximum square footage of a single area given in Table 2607.4 shall be increased 100 percent, but the area of light-transmitting plastic wall panels shall not exceed 50 percent of the wall area in any story, or the area permitted by Section 705.9 for unprotected openings, whichever is smaller. These installations shall not be installed more than 75 feet (22 860 mm) above grade plane.

2607.6 Combinations of glazing and wall panels. Combinations of light-transmitting plastic glazing and light-transmitting plastic wall panels shall be subject to the area, height and percentage limitations and the separation requirements applicable to the class of light-transmitting plastic as prescribed for light-transmitting plastic wall panel installations.

SECTION 2608—LIGHT-TRANSMITTING PLASTIC GLAZING

2608.1 Buildings of Type VB construction. Openings in the exterior walls of buildings of Type VB construction, where not required to be protected by Section 705, shall be permitted to be glazed or equipped with light-transmitting plastic. Light-transmitting plastic glazing shall comply with Section 2606.

2608.2 Buildings of other types of construction. Openings in the exterior walls of buildings of types of construction other than Type VB, where not required to be protected by Section 705, shall be permitted to be glazed or equipped with light-transmitting plastic in accordance with Section 2606 and all of the following:

1. The aggregate area of light-transmitting plastic glazing shall not exceed 25 percent of the area of any wall face of the story in which it is installed. The area of a single pane of glazing installed above the first story above grade plane shall not exceed 16 square feet (1.5 m^2) and the vertical dimension of a single pane shall not exceed 4 feet (1219 mm).

   Exception: Where an automatic sprinkler system is provided throughout in accordance with Section 903.3.1.1, the area of allowable glazing shall be increased to not more than 50 percent of the wall face of the story in which it is installed with no limit on the maximum dimension or area of a single pane of glazing.
2. Approved flame barriers extending 30 inches (762 mm) beyond the exterior wall in the plane of the floor, or vertical panels not less than 4 feet (1219 mm) in height, shall be installed between glazed units located in adjacent stories.

   Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade level.

   Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

SECTION 2609—LIGHT-TRANSMITTING PLASTIC ROOF PANELS

2609.1 General. Light-transmitting plastic roof panels shall comply with this section and Section 2606. Light-transmitting plastic roof panels shall not be installed in Groups H, I-2 and I-3. In all other groups, light-transmitting plastic roof panels shall comply with any one of the following conditions:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The roof construction is not required to have a fire-resistance rating by Table 601.
3. The roof panels meet the requirements for roof coverings in accordance with Chapter 15.

2609.2 Separation. Individual roof panels shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

Exceptions:

1. The separation between roof panels is not required in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The separation between roof panels is not required in low-hazard occupancy buildings complying with the conditions of Section 2609.4, Exception 2 or 3.

2609.3 Location. Where exterior wall openings are required to be protected by Section 705.9, a roof panel shall not be installed within 6 feet (1829 mm) of such exterior wall.

2609.4 Area limitations. Roof panels shall be limited in area and the aggregate area of panels shall be limited by a percentage of the floor area of the room or space sheltered in accordance with Table 2609.4.

Exceptions:

1. The area limitations of Table 2609.4 shall be permitted to be increased by 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Low-hazard occupancy buildings, such as swimming pool shelters, shall be exempt from the area limitations of Table 2609.4, provided that the buildings do not exceed 5,000 square feet (465 m^2) in area and have a minimum fire separation distance of 10 feet (3048 mm).
3. Greenhouses that are occupied for growing or maintaining plants, without public access, shall be exempt from the area limitations of Table 2609.4 provided that they have a minimum fire separation distance of 4 feet (1220 mm).
4. Roof coverings over terraces and patios in occupancies in Group R-3 shall be exempt from the area limitations of Table 2609.4 and shall be permitted with light-transmitting plastics.

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TABLE 2609.4—AREA LIMITATIONS FOR LIGHT-TRANSMITTING PLASTIC ROOF PANELS		
CLASS OF PLASTIC	MAXIMUM AREA OF INDIVIDUAL ROOF PANELS (square feet)	MAXIMUM AGGREGATE AREA OF ROOF PANELS (percent of floor area)
CC1	300	30
CC2	100	25
For SI: 1 square foot = 0.0929 m^2.		

SECTION 2610—LIGHT-TRANSMITTING PLASTIC SKYLIGHT GLAZING

2610.1 Light-transmitting plastic glazing of skylight assemblies. Skylight assemblies glazed with light-transmitting plastic shall conform to the provisions of this section and Section 2606.

Exception: Skylights in which the light-transmitting plastic conforms to the required roof-covering class in accordance with Section 1505.

2610.1.1 Unit skylights. Unit skylights glazed with light-transmitting plastic shall comply with Section 2405.5.

2610.2 Mounting. The light-transmitting plastic shall be mounted above the plane of the roof on a curb constructed in accordance with the requirements for the type of construction classification, but not less than 4 inches (102 mm) above the plane of the roof. Edges of the light-transmitting plastic skylights or domes shall be protected by metal or other approved noncombustible material, or the light transmitting plastic dome or skylight shall be shown to be able to resist ignition where exposed at the edge to a flame from a Class B brand as described in ASTM E108 or UL 790. The Class B brand test shall be conducted on a skylight that is elevated to a height as specified in the manufacturer's installation instructions, but not less than 4 inches (102 mm).

Exceptions:

1. Curbs shall not be required for skylights used on roofs having a minimum slope of three units vertical in 12 units horizontal (25-percent slope) in occupancies in Group R-3 and on buildings with a nonclassified roof covering.
2. The metal or noncombustible edge material is not required where nonclassified roof coverings are permitted.

2610.3 Slope. Flat or corrugated light-transmitting plastic skylights shall slope not less than four units vertical in 12 units horizontal (4:12). Dome-shaped skylights shall rise above the mounting flange a minimum distance equal to 10 percent of the maximum width of the dome but not less than 3 inches (76 mm).

Exception: Skylights that pass the Class B Burning Brand Test specified in ASTM E108 or UL 790.

2610.4 Maximum area of skylights. Each skylight shall have a maximum area within the curb of 100 square feet (9.3 m^2).

Exception: The area limitation shall not apply where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

2610.5 Aggregate area of skylights. The aggregate area of skylights shall not exceed $33^1/_3$ percent of the floor area of the room or space sheltered by the roof in which such skylights are installed where Class CC1 materials are utilized, and 25 percent where Class CC2 materials are utilized.

Exception: The aggregate area limitations of light-transmitting plastic skylights shall be increased 100 percent beyond the limitations set forth in this section where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

2610.6 Separation. Skylights shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

Exceptions:

1. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. In Group R-3, multiple skylights located above the same room or space with a combined area not exceeding the limits set forth in Section 2610.4.

2610.7 Location. Where exterior wall openings are required to be protected in accordance with Section 705, a skylight shall not be installed within 6 feet (1829 mm) of such exterior wall.

2610.8 Combinations of roof panels and skylights. Combinations of light-transmitting plastic roof panels and skylights shall be subject to the area and percentage limitations and separation requirements applicable to roof panel installations.

SECTION 2611—LIGHT-TRANSMITTING PLASTIC INTERIOR SIGNS

2611.1 General. Light-transmitting plastic interior signs shall be limited as specified in Sections 2606 and 2611.2 through 2611.4.

Exception: Light-transmitting plastic interior wall signs in covered and open mall buildings shall comply with Section 402.6.4.

2611.2 Maximum area. The aggregate area of all light-transmitting plastics shall not exceed 24 square feet (2.23 m^2).

Exception: In buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the aggregate area of light-transmitting plastics shall not exceed 100 square feet (9.29 m^2), provided that all plastics are Class CC1 in accordance with Section 2606.4.

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2611.3 Separation. Signs exceeding the aggregate area of Section 2611.2 shall be separated from each other by not less than 4 feet (1219 mm) horizontally and 8 feet (2438 mm) vertically.

2611.4 Encasement. Backs of wall-mounted signs and non-illuminated portions of all signs regulated by this section shall be fully encased in metal.

SECTION 2612—PLASTIC COMPOSITE DECKING

[BS] 2612.1 General. Plastic composites shall consist of either wood/plastic composites or plastic lumber. Plastic composites shall comply with the provisions of this code and with the additional requirements of Section 2612.

[BS] 2612.2 Labeling. Plastic composite deck boards and stair treads, or their packaging, shall bear a label that indicates compliance with ASTM D7032 and includes the allowable load and maximum allowable span determined in accordance with ASTM D7032. Plastic composite handrails and guards, or their packaging, shall bear a label that indicates compliance with ASTM D7032 and includes the maximum allowable span determined in accordance with ASTM D7032.

[BF] 2612.3 Flame spread index. Plastic composite deck boards, stair treads, handrails and guards shall exhibit a flame spread index not exceeding 200 when tested in accordance with ASTM E84 or UL 723 with the test specimen remaining in place during the test.

Exception: Materials determined to be noncombustible in accordance with Section 703.3.

[BS] 2612.4 Termite and decay resistance. Where required by Section 2304.12, plastic composite deck boards, stair treads, handrails and guards containing wood, cellulosic or any other biodegradable materials shall be termite and decay resistant as determined in accordance with ASTM D7032.

[BS] 2612.5 Construction requirements. Plastic composites meeting the requirements of Section 2612 shall be permitted to be used as exterior deck boards, stair treads, handrails and guards where combustible construction is permitted.

[BS] 2612.5.1 Span rating. Plastic composites used as exterior deck boards shall have a span rating determined in accordance with ASTM D7032.

[BS] 2612.6 Plastic composite deck boards, stair treads, handrails and guards. Plastic composite deck boards, stair treads, handrails and guards shall be installed in accordance with this code and the manufacturer's instructions.

SECTION 2613—FIBER-REINFORCED POLYMER

2613.1 General. The provisions of this section shall govern the requirements and uses of fiber-reinforced polymer in and on buildings and structures.

2613.2 Labeling and identification. Packages and containers of fiber-reinforced polymer and their components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

2613.3 Interior finishes. Fiber-reinforced polymer used as interior finishes, decorative materials or trim shall comply with Chapter 8.

2613.3.1 Foam plastic cores. Fiber-reinforced polymer used as interior finish and that contains foam plastic cores shall comply with Chapter 8 and this chapter.

2613.4 Light-transmitting materials. Fiber-reinforced polymer used as light-transmitting materials shall comply with Sections 2606 through 2611 as required for the specific application.

2613.5 Exterior use. Fiber-reinforced polymer shall be permitted to be installed on the exterior walls of buildings of any type of construction where such polymers meet the requirements of Section 2603.5. Fireblocking shall be installed in accordance with Section 718.

Exceptions:

1. Compliance with Section 2603.5 is not required where all of the following conditions are met:
   - 1.1. The fiber-reinforced polymer shall not exceed an aggregate total of 20 percent of the area of the specific wall to which it is attached, and single architectural elements shall not exceed 10 percent of the area of the specific wall to which it is attached, and no contiguous sets of architectural elements shall not exceed 10 percent of the area of the specific wall to which they are attached.
   - 1.2. The fiber-reinforced polymer shall have a flame spread index of 25 or less. The flame spread index requirement shall not be required for coatings or paints having a thickness of less than 0.036 inch (0.9 mm) that are applied directly to the surface of the fiber-reinforced polymer.
   - 1.3. Fireblocking complying with Section 718.2.6 shall be installed.
   - 1.4. The fiber-reinforced polymer shall be installed directly to a noncombustible substrate or be separated from the exterior wall by one of the following materials: corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm) at any point, aluminum having a minimum thickness of 0.019 inch (0.5 mm) or other approved noncombustible material.
2. Compliance with Section 2603.5 is not required where the fiber-reinforced polymer is installed on buildings that are 40 feet (12 190 mm) or less above grade and the following conditions are met:
   - 2.1. The fiber-reinforced polymer shall meet the requirements of Section 1405.1.

2.2. Where the fire separation distance is 5 feet (1524 mm) or less, the area of the fiber-reinforced polymer shall not exceed 10 percent of the wall area. Where the fire separation distance is greater than 5 feet (1524 mm), the area of the exterior wall coverage using fiber-reinforced polymer shall not be limited.

2.3. The fiber-reinforced polymer shall have a flame spread index of 200 or less. The flame spread index requirements do not apply to coatings or paints having a thickness of less than 0.036 inch (0.9 mm) that are applied directly to the surface of the fiber-reinforced polymer.

2.4. Fireblocking complying with Section 718.2.6 shall be installed.

SECTION 2614—REFLECTIVE PLASTIC CORE INSULATION

2614.1 General. The provisions of this section shall govern the requirements and uses of reflective plastic core insulation in buildings and structures. Reflective plastic core insulation shall comply with the requirements of Section 2614 and of Section 2614.3 or 2614.4.

2614.2 Identification. Packages and containers of reflective plastic core insulation delivered to the job site shall show the manufacturer's or supplier's name, product identification and information sufficient to determine that the end use will comply with the code requirements.

2614.3 Surface-burning characteristics. Reflective plastic core insulation shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested in accordance with ASTM E84 or UL 723. The reflective plastic core insulation shall be tested at the maximum thickness intended for use. Test specimen preparation and mounting shall be in accordance with ASTM E2599.

2614.4 Room corner test heat release. Reflective plastic core insulation shall comply with the acceptance criteria of Section 803.1.1.1 when tested in accordance with NFPA 286 or UL 1715 in the manner intended for use and at the maximum thickness intended for use.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 27 – ELECTRICAL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)			**X**																					
Adopt only those sections that are listed below																								
Chapter / Section																								
2702.1.2			X																					
2702.2.11			X																					
2702.2.13			X																					

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

27 ELECTRICAL

User notes:

About this chapter: Electrical systems and components are integral to most structures; therefore, it is necessary for the code to address their installation and protection. Structures depend on electricity for the operation of many life safety systems including fire alarm, smoke control and exhaust, fire suppression, fire command and communication systems. Since power supply to these systems is essential, Chapter 27 addresses where standby and emergency power must be provided.

ICC code development note: Code change proposals to sections preceded by the designation [F] will be considered by the IFC code development committee meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2025 (Group B) Code Development Cycle.

SECTION 2701—GENERAL

2701.1 Scope. The provisions of this chapter and *the California Electrical Code* shall govern the design, construction, erection and installation of the electrical components, appliances, equipment and systems used in buildings and structures covered by this code. The *California Fire Code*, the *International Property Maintenance Code* and *the California Electrical Code* shall govern the use and maintenance of electrical components, appliances, equipment and systems. The *California Existing Building Code* and *the California Electrical Code* shall govern the alteration, repair, relocation, replacement and addition of electrical components, appliances, or equipment and systems.

SECTION 2702—EMERGENCY AND STANDBY POWER SYSTEMS

[F] 2702.1 General. Emergency power systems and standby power systems shall comply with Sections 2702.1.1 through 2702.1.8.

[F] 2702.1.1 Stationary generators. Stationary emergency and standby power generators required by this code shall be listed in accordance with UL 2200.

[F] 2702.1.2 Fuel-line piping protection. Fuel lines supplying a generator set inside a high-rise building *or new Group I-2 occupancy having occupied floors located more than 75 feet (23 m) above the lowest level of fire department vehicle access* shall be separated from areas of the building other than the room the generator is located in by one of the following methods:

1. A fire-resistant pipe-protection system that has been tested in accordance with UL 1489. The system shall be installed as tested and in accordance with the manufacturer's installation instructions, and shall have a rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required rating shall be reduced to 1 hour.
2. An assembly that has a fire-resistance rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required fire-resistance rating shall be reduced to 1 hour.
3. Other approved methods.

[F] 2702.1.3 Installation. Emergency power systems and standby power systems required by this code or the *California Fire Code* shall be installed in accordance with the *California Fire Code*, *the California Electrical Code*, NFPA 110 and NFPA 111.

[F] 2702.1.4 Load transfer. Emergency power systems shall automatically provide secondary power within 10 seconds after primary power is lost, unless specified otherwise in this code. Standby power systems shall automatically provide secondary power within 60 seconds after primary power is lost, unless specified otherwise in this code.

[F] 2702.1.5 Load duration. Emergency power systems and standby power systems shall be designed to provide the required power for a minimum duration of 2 hours without being refueled or recharged, unless specified otherwise in this code.

[F] 2702.1.6 Uninterruptable power source. An uninterrupted source of power shall be provided for equipment where required by the manufacturer's instructions, the listing, this code or applicable referenced standards.

[F] 2702.1.7 Interchangeability. Emergency power systems shall be an acceptable alternative for installations that require standby power systems.

[F] 2702.1.8 Group I-2 occupancies. In Group I-2 occupancies located in flood hazard areas established in Section 1612.3, where new essential electrical systems are installed, and where new essential electrical system generators are installed, the systems and generators shall be located and installed in accordance with ASCE 24. Where connections for hookup of temporary generators are provided, the connections shall be located at or above the elevation required in ASCE 24.

[F] 2702.2 Where required. Emergency and standby power systems shall be provided where required by Sections 2702.2.1 through 2702.2.19.

[F] 2702.2.1 Ambulatory care facilities. Essential electrical systems for ambulatory care facilities shall comply with Section 422.6.

[F] 2702.2.2 Elevators and platform lifts. Standby power shall be provided for elevators and platform lifts as required in Sections 1009.4.1, 1009.5, 3003.1, 3007.8 and 3008.8.

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[F] 2702.2.3 Emergency responder communication coverage systems. Standby power shall be provided for in-building 2-way emergency responder communication coverage systems required in Section 918 and the *California Fire Code*. The standby power supply shall be capable of operating the in-building 2-way emergency responder communication coverage system at 100-percent system operation capacity for a duration of not less than 12 hours.

[F] 2702.2.4 Emergency voice/alarm communication systems. Standby power shall be provided for emergency voice/alarm communication systems in accordance with NFPA 72.

[F] 2702.2.5 Exhaust systems. Standby power shall be provided for common exhaust systems for domestic kitchens located in multistory structures as required in Section 505.5 of the *California Mechanical Code*. Standby power shall be provided for common exhaust systems for clothes dryers located in multistory *structures* as required in Section 504.11 of the *California Mechanical Code* and Section 614.11 of the *International Fuel Gas Code*.

[F] 2702.2.6 Exit signs. Emergency power shall be provided for exit signs as required in Section 1013.6.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[F] 2702.2.7 Gas detection system. Emergency or standby power shall be provided for gas detection systems in accordance with the *California Fire Code*.

[F] 2702.2.8 Group I-2 occupancies. Essential electrical systems for Group I-2 occupancies shall be in accordance with Section 407.11.

[F] 2702.2.9 Group I-3 occupancies. Emergency power shall be provided for power-operated doors and locks in Group I-3 occupancies as required in Section 408.4.2.

[F] 2702.2.10 Hazardous materials. Emergency or standby power shall be provided in occupancies with hazardous materials where required by the *California Fire Code*.

[F] 2702.2.11 High-rise buildings *and Group I-2 Occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access*. Emergency and standby power shall be provided in high-rise buildings *and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access* as required in Section 403.4.8.

[F] 2702.2.12 Hydrogen fuel gas rooms. Standby power shall be provided for hydrogen fuel gas rooms as required by the *California Fire Code*.

2702.2.13 Group L Occupancy. *Secondary power shall be provided in Group L occupancies in accordance with this chapter and Section 453.4.6 and 453.4.6.1.*

[F] 2702.2.14 Means of egress illumination. Emergency power shall be provided for means of egress illumination as required in Section 1008.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[F] 2702.2.15 Membrane structures. Standby power shall be provided for auxiliary inflation systems in permanent membrane structures as required in Section 3102.8.2. Standby power shall be provided for a duration of not less than 4 hours. Auxiliary inflation systems in temporary air-supported and air-inflated membrane structures shall be provided in accordance with Section 3103.9.4 of the *California Fire Code*.

[F] 2702.2.16 Semiconductor fabrication facilities. Emergency power shall be provided for semiconductor fabrication facilities as required in Section 415.11.11.

[F] 2702.2.17 Smoke control systems. Standby power shall be provided for smoke control systems as required in Sections 404.7, 909.11, 909.20.7.2 and 909.21.5.

[F] 2702.2.18 Special purpose horizontal sliding, accordion or folding doors. Standby power shall be provided for special purpose horizontal sliding, accordion or folding doors as required in Section 1010.3.3. The standby power supply shall have a capacity to operate not fewer than 50 closing cycles of the door.

[F] 2702.2.19 Underground buildings. Emergency and standby power shall be provided in underground buildings as required in Section 405.

[F] 2702.3 Critical circuits. Required critical circuits shall be protected using one of the following methods:

1. Cables, used for survivability of required critical circuits, that are listed in accordance with UL 2196 and have a fire-resistance rating of not less than 1 hour.
2. Electrical circuit protective systems having a fire-resistance rating of not less than 1 hour. Electrical circuit protective systems are installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 1 hour.

[F] 2702.4 Maintenance. Emergency and standby power systems shall be maintained and tested in accordance with the *California Fire Code*.

SECTION 2703—LIGHTNING PROTECTION SYSTEMS

2703.1 General. Where provided, lightning protection systems shall comply with Sections 2703.2 through 2703.3.

2703.2 Installation. Lightning protection systems shall be installed in accordance with NFPA 780 or UL 96A. UL 96A shall not be utilized for buildings used for the production, handling or storage of ammunition, explosives, flammable liquids, flammable gases or other explosive ingredients including dust.

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2703.2.1 Surge protection. Where lightning protection systems are installed, surge protective devices shall also be installed in accordance with the *California Electrical Code* and either NFPA 780 or UL 96A, as applicable.

2703.3 Interconnection of systems. All lightning protection systems on a building or structure shall be interconnected in accordance with NFPA 780 or UL 96A, as applicable.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 28 – MECHANICAL SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)			**X**																					
Adopt only those sections that are listed below																								
Chapter / Section																								
2802			X																					

The state agency does not adopt sections identified with the following symbol: †

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CHAPTER
28
MECHANICAL SYSTEMS

User notes:

About this chapter: Mechanical systems are a key element of any building. Chapter 28 regulates such systems by linking to the *California Mechanical Code* and *California Plumbing Code*, where details of mechanical system requirements are provided.

SECTION 2801—GENERAL

[M] 2801.1 Scope. The provisions of this chapter, the *California Mechanical Code* and the *California Plumbing Code* shall govern the design, construction, erection and installation of mechanical appliances, equipment and systems used in buildings and structures covered by this code. Masonry chimneys, fireplaces and barbecues shall comply with the *California Mechanical Code* and Chapter 21 of this code. The *California Fire Code*, the *International Property Maintenance Code*, the *California Mechanical Code* and the *California Plumbing Code* shall govern the use and maintenance of mechanical components, appliances, equipment and systems. The *California Existing Building Code*, the *California Mechanical Code* and the *California Plumbing Code* shall govern the alteration, repair, relocation, replacement and addition of mechanical components, appliances, equipment and systems.

SECTION 2802—SPARK ARRESTOR [SFM]

2802.1 Spark arrestor. [SFM] *All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester. The spark arrestor shall meet all of the following requirements:*

1. *The net free area of the spark arrestor shall be not less than four times the net free area of the outlet of the chimney.*
2. *The spark arrestor screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.*
3. *Openings shall not permit the passage of spheres having a diameter larger than $^{1}/_{2}$ inch (12.7 mm) nor block the passage of spheres having a diameter of less than $^{3}/_{8}$ inch (9.5 mm).*
4. *The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.*

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CHAPTER
29

PLUMBING SYSTEMS

(Not Adopted By The State Of California)

Refer To California Plumbing Code, Title 24, Part 5

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 30 – ELEVATORS AND CONVEYING SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X							X	X		X	X	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)			X							X														
Adopt only those sections that are listed below						X	X																	
Chapter / Section																								
3001.2			X																					
3001.3			X																					
3001.4			X			X	X																	
3001.5			X																					
3001.7			X																					
3002.4a – 3002.4.6a			X																					
3002.5			X																					
3002.6.1			X																					
3002.9			X																					
3002.10 – 3002.11			X																					
3003.1			X																					
3003.1.4			X																					
3003.1.5			X																					
3003.2			X																					
3003.2.1			X																					
3003.2.1.1			X																					
3003.2.1.2			X																					
3003.4 – 3003.4.4			X																					
3005.1 – 3005.2			X																					
3005.4.1			X																					
3006.2			X																					
3006.3			X																					
3007.1			X																					
3007.6.1			X																					
3008.1			X																					
3008.1.4			X																					
3008.2.1			X																					
3008.7.1			X																					
3009.1 – 3009.3			X																					
3010										X														

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

30

ELEVATORS AND CONVEYING SYSTEMS

User notes:

About this chapter: Chapter 30 contains the provisions that regulate vertical and horizontal transportation and material-handling systems installed in buildings. This chapter also provides several elements that protect occupants and assist emergency responders during fires.

ICC code development note: Code change proposals to sections preceded by the designation [F] and [BE] will be considered by a code development committee meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2025 (Group B) Code Development Cycle.

SECTION 3001—GENERAL

3001.1 Scope. This chapter governs the design, construction, installation, alteration and repair of elevators and conveying systems and their components.

3001.2 Elevator emergency communication systems. An elevator emergency two-way communication system that includes both visual and audible communication modes complying with the requirements in *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders,* shall be provided in each elevator car. The system shall provide a means to enable authorized personnel to verify:

1. The presence of someone in the car.
2. That the person(s) is trapped.

Once an entrapment is verified, the system shall enable authorized personnel to:

1. Determine if assistance is needed.
2. Communicate when help is on the way.
3. Communicate when help arrives on site.

3001.3 Referenced standards. The design, construction, installation, alteration, repair and maintenance of elevators and conveying systems and their components shall conform to *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders, and* the applicable standard specified in Table 3001.3 and Section 3001.6.

TABLE 3001.3—ELEVATORS AND CONVEYING SYSTEMS AND COMPONENTS

TYPE	STANDARD
Automotive lifts	ALI ALCTV
Belt manlifts	ASME A90.1
Conveyors and related equipment	ASME B20.1
Elevators, escalators, dumbwaiters, moving walks, material lifts	ASME A17.1/CSA B44, ASME A17.7/CSA B44.7
Industrial scissor lifts	ANSI MH29.1
Platform lifts, stairway chairlifts, wheelchair lifts	ASME A18.1

[BE] 3001.4 Accessibility. Passenger elevators *and platform (wheelchair) lifts* required to be accessible or to serve as part of an accessible means of egress shall comply with Sections 1009 and *either Chapter 11A for applications listed in Section 1.8.2.1.2 regulated by the Department of Housing and Community Development or Chapter 11B for applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance.*

3001.5 Change in use. A change in use of an elevator from freight to passenger, passenger to freight, or from one freight class to another freight class shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

3001.6 Structural design. All interior and exterior elevators, escalators and other conveying systems and their components shall comply with all applicable design loading criteria in Chapter 16, including wind, flood and seismic loads established in Sections 1609, 1612 and 1613.

3001.7 Elevators utilized to transport hazardous materials. *Elevators utilized to transport hazardous materials shall also comply with the California Fire Code Sections 5003.10.2.2, 5003.10.4 through 5003.10.7.*

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SECTION 3002—HOISTWAY ENCLOSURES

3002.1 Hoistway protection. A hoistway for elevators, dumbwaiters and other vertical-access devices shall comply with Sections 712 and 713. Where the hoistway is required to be enclosed, it shall be constructed as a shaft enclosure in accordance with Section 713.

3002.1.1 Opening protectives. Openings in fire-resistance-rated hoistway enclosures shall be protected as required in Chapter 7.

Exception: The elevator car doors and the associated hoistway doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I Emergency Recall Operation.

3002.1.2 Hardware. Hardware on elevator hoistway doors shall be of an approved type installed as tested, except that approved interlocks, mechanical locks and electric contacts, door and gate electric contacts and door-operating mechanisms shall be exempt from the fire test requirements.

3002.2 Number of elevator cars in a hoistway. Where four or more elevator cars serve all or the same portion of a building, the elevators shall be located in not fewer than two separate fire-resistance-rated hoistways. Not more than four elevator cars shall be located in any single fire-resistance-rated hoistway enclosure.

3002.3 Emergency signs. A pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. Where elevators are not a component of the accessible means of egress, the sign shall read: IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT. Where the elevator is a component of the accessible means of egress, a sign complying with Section 1009.11 shall be provided.

Exception: The emergency sign shall not be required for elevators that are used for occupant self-evacuation in accordance with Section 3008.

3002.4 Elevator car to accommodate ambulance stretcher. Where elevators are provided in buildings four or more stories above, or four or more stories below, grade plane, not fewer than one elevator shall be provided for fire department emergency access to all floors. The elevator car shall be of such a size and arrangement to accommodate an ambulance stretcher 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-inch (127 mm) radius corners, in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). The symbol shall be not less than 3 inches (76 mm) in height and shall be placed inside on both sides of the hoistway door frame.

The following California sections replace the corresponding model code section for applications specified in section 1.11 for the Office of the State Fire Marshal.

3002.4a General stretcher requirements. *All buildings and structures with one or more passenger service elevators shall be provided with not less than one medical emergency service elevator to all landings meeting the provisions of Section 3002.4a. The medical emergency service elevator(s) shall be identified in the construction documents specified in Section 107 or the California Administrative Code.*

Exceptions:

1. *Elevators in structures used only by maintenance and operating personnel.*
2. *Elevators in jails and penal institutions.*
3. *Elevators in buildings or structures where each landing is at ground level or is accessible at grade level or by a ramp.*
4. *Elevator(s) in two-story buildings or structures equipped with stairs of a configuration that will accommodate the carrying of the gurney or stretcher as permitted by the local jurisdictional authority.*
5. *Elevators in buildings or structures less than four stories in height for which the local jurisdictional authority has granted an exception in the form of a written document.*

3002.4.1a Gurney size. *The medical emergency service elevator shall accommodate the loading and transport of two emergency personnel, each requiring a minimum clear 21-inch (533 mm) diameter circular area and an ambulance gurney or stretcher [minimum size 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-inch (127 mm) radius corners] in the horizontal, open position.*

3002.4.2a Hoistway doors. *The hoistway landing openings shall be provided with power-operated doors.*

3002.4.3a Elevator recall. *The elevator(s) designated the medical emergency elevator shall be equipped with a key switch to recall the elevator nonstop to the main floor. For the purpose of this section, elevators in compliance with Section 3003.2 shall be acceptable.*

3002.4.4a Designation. *Medical emergency elevators shall be identified by the international symbol (Star of Life) for emergency medical services.*

3002.4.5a Symbol size. *The symbol shall not be less than 3 inches (76 mm) in size.*

3002.4.6a Symbol location. *A symbol shall be permanently attached to each side of the hoistway door frame on the portion of the frame at right angles to the hallway or landing area. Each symbol shall be not less than 78 inches (1981 mm) and not more than 84 inches (2134 mm) above the floor level at the threshold.*

3002.5 Emergency doors. Where an elevator is installed in a single blind hoistway or on the outside of a building, there shall be installed in the blind portion of the hoistway or blank face of the building, an emergency door *shall be in conformance with the California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

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3002.6 Prohibited doors or other devices. Doors or other devices, other than the elevator car door and the associated elevator hoistway doors, shall be prohibited at the point of access to an elevator car unless such doors or other devices are readily openable from inside the car without a key, tool, special knowledge or effort.

3002.6.1 Prohibited hoistway access doors and panels. *The following types of access doors and panels are prohibited in accordance with the California Code Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders:*

1. *Access panels or doors to working platforms in the line of movement of the car counterweight in the hoistway.*
2. *Access panels or doors in the hoistway for access to car or hoistway transparent enclosures.*

3002.7 Common enclosure with stairway. Elevators shall not be in a common shaft enclosure with a stairway.

Exception: Elevators within open parking garages need not be separated from stairway enclosures.

3002.8 Glass in elevator enclosures. Glass in elevator enclosures shall comply with Section 2409.2.

3002.9 Plumbing and mechanical systems. Plumbing and mechanical systems shall not be located in an elevator hoistway enclosure *unless permitted by California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

Exception: Floor drains *and* sumps and sump pumps shall be permitted at the base of the hoistway enclosure provided that they are indirectly connected to the plumbing system.

3002.10 Photoelectric tube bypass switch.

3002.10.1 *Elevators equipped with photoelectric tube devices which control the closing of automatic, power-operated car or hoistway doors, or both, shall have a switch in the car which, when actuated, will render the photoelectric tube device ineffective.*

3002.10.2 *The switch shall be constant-pressure type, requiring not less than 10 pounds (44.5N) or more than 15 pounds (66.7 N) pressure to actuate.*

3002.10.3 *The switch shall be located not less than 6 feet (1829 mm) or more than 6 feet 6 inches (1981 mm) above the car floor and shall be located in or adjacent to the operating panel.*

3002.10.4 *The switch shall be clearly labeled TO BE USED IN CASE OF FIRE ONLY.*

3002.10.5 *Switches shall be kept in working order or be removed when existing installations are arranged to comply with Section 3002.10.5, Exception 1 or 2.*

Exceptions:

1. *Elevators installed and maintained in compliance with Section 3003.*
2. *Where alternate means acceptable to the fire authority having jurisdiction are provided that will ensure the doors can close under adverse smoke conditions.*

3002.11 Pit access door. *Where separate pit access door(s) are required for access to pit(s) located below the bottom hoistway door landing, permanent stairway access shall be provided to the access door.*

SECTION 3003—EMERGENCY OPERATIONS

[F] 3003.1 Standby power. In buildings and structures where standby power is required or furnished to operate an elevator, the operation shall be in accordance with *Section 1203 of the California Fire Code and* Sections 3003.1.1 through 3003.1.*5 of this code.*

[F] 3003.1.1 Manual transfer. Standby power shall be manually transferable to all elevators in each bank.

[F] 3003.1.2 One elevator. Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

[F] 3003.1.3 Two or more elevators. Where two or more elevators are controlled by a common operating system, all elevators shall automatically transfer to standby power within 60 seconds after failure of normal power where the standby power source is of sufficient capacity to operate all elevators at the same time. Where the standby power source is not of sufficient capacity to operate all elevators at the same time, all elevators shall transfer to standby power in sequence, return to the designated landing and disconnect from the standby power source. After all elevators have been returned to the designated level, not less than one elevator shall remain operable from the standby power source.

[F] 3003.1.4 ***Temperature and humidity control.*** Where standby power is connected to elevators, the machine room *machine space, control room and control space* ventilation or air conditioning *system* shall be connected to the standby power source.

3003.1.5 Emergency hoistway venting. *Where standby power is connected to elevators, the emergency hoistway ventilation system, if required, shall be connected to the standby power source.*

[F] 3003.2 Firefighters' emergency operation. Elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

3003.2.1 Floor numbers. *Elevator hoistways shall have a floor number not less than 4 inches (102 mm) in height, placed on the walls and/or doors of the hoistway at intervals such that a person in a stalled elevator, upon opening the car door, can determine the floor position.*

3003.2.1.1 Fire signs. *All automatic elevators shall have not less than one sign at each landing printed on a contrasting background in letters not less than $^{1}/_{2}$ inch (12.7 mm) high to read: IN CASE OF FIRE USE STAIRWAY FOR EXIT. DO NOT USE ELEVATOR.*

3003.2.1.2 Call and car operation buttons. *Automatic passenger elevators shall have call and car operation buttons within 60 inches (1524 mm) of the floor. Emergency telephones shall also be within 60 inches (1524 mm) of the floor.*

[F] 3003.3 Standardized fire service elevator keys. All elevators shall be equipped to operate with a standardized fire service elevator key in accordance with the *California Fire Code*.

3003.4 Emergency hoistway venting. *Elevator hoistways containing the driving machine shall be provided with a means for venting smoke and hot gases to the outer air in case of fire.*

3003.4.1 Location of vents. *Vents shall be located at the top of the hoistway and shall open either directly to the outer air or through noncombustible ducts to the outer air.*

3003.4.2 Area of vents. *Except as provided for in Section 3003.1.4.4, the area of the vents shall be not less than $3^1/_2$ percent of the area of the hoistway nor less than 3 square feet (0.28 m^2) for each elevator car.*

3003.4.3 Operation of vents. *Vent openings shall automatically open upon detection of smoke in the elevator hoistway and upon activation of a manual override control. The manual override control shall be capable of opening and closing the vents and shall be located in an approved location. Smoke detectors provided in elevator hoistways to activate the hoistway ventilation system, shall also be required to activate the elevator Phase I emergency recall operation function in accordance with California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

3003.4.4 Reduced vent area. *Where mechanical ventilation conforming to the California Mechanical Code is provided, a reduction in the required vent area is allowed provided that all of the following conditions are met:*

1. *The vents required by Section 3003.1.4.1 of the California Building Code do not have outside exposure.*
2. *The hoistway does not extend to the top of the building.*
3. *The hoistway exhaust fan is automatically reactivated by thermostatic means.*
4. *Equivalent venting of the hoistway is accomplished.*

SECTION 3004—CONVEYING SYSTEMS

3004.1 General. Escalators, moving walks, conveyors, personnel hoists and material hoists shall comply with the provisions of Sections 3004.2 through 3004.4.

3004.2 Escalators and moving walks. Escalators and moving walks shall be constructed of approved noncombustible and fire-retardant materials. This requirement shall not apply to electrical equipment, wiring, wheels, handrails and the use of $^1/_{28}$-inch (0.9 mm) wood veneers on balustrades backed up with noncombustible materials.

3004.2.1 Enclosure. Escalator floor openings shall be enclosed with shaft enclosures complying with Section 713.

3004.2.2 Escalators. Where provided in below-grade transportation stations, escalators shall have a clear width of not less than 32 inches (815 mm).

3004.3 Conveyors. Conveyors and conveying systems shall comply with ASME B20.1.

3004.3.1 Enclosure. Conveyors and related equipment connecting successive floors or levels shall be enclosed with shaft enclosures complying with Section 713.

3004.3.2 Conveyor safeties. Power-operated conveyors, belts and other material-moving devices shall be equipped with automatic limit switches that will shut off the power in an emergency and automatically stop all operation of the device.

3004.4 Personnel and material hoists. Personnel and material hoists shall be designed utilizing an approved method that accounts for the conditions imposed during the intended operation of the hoist device. The design shall include, but is not limited to, anticipated loads, structural stability, impact, vibration, stresses and seismic restraint. The design shall account for the construction, installation, operation and inspection of the hoist tower, car, machinery and control equipment, guide members and hoisting mechanism. Additionally, the design of personnel hoists shall include provisions for field testing and maintenance that will demonstrate that the hoist device functions in accordance with the design. Field tests shall be conducted upon the completion of an installation or following a major alteration of a personnel hoist.

SECTION 3005—MACHINE ROOMS

3005.1 Access. *A permanent and* approved means of access shall be provided to elevator machine rooms, control rooms, control spaces and machinery spaces.

3005.2 Temperature *and humidity* control. Elevator machine rooms, machinery spaces that contain the driving machine, and control rooms or spaces that contain the operation or motion controller for elevator operation shall be provided with an independent ventilation or air-conditioning system to protect against the overheating of the electrical equipment. The system shall *maintain the temperature and humidity* be capable of maintaining temperatures within the range established *by the manufacturer of* the elevator equipment.

3005.3 Pressurization. The elevator machine room, control rooms or control space with openings into a pressurized elevator hoistway shall be pressurized upon activation of a heat or smoke detector located in the elevator machine room, control room or control space.

3005.4 Machine rooms, control rooms, machinery spaces, and control spaces. The following rooms and spaces shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both:

1. Machine rooms.
2. Control rooms.

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3. Control spaces.
4. Machinery spaces outside of the hoistway enclosure.

The fire-resistance rating shall be not less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors.

Exceptions:

1. For other than fire service access elevators and occupant evacuation elevators, where machine rooms, machinery spaces, control rooms and control spaces do not abut and do not have openings to the hoistway enclosure they serve, the fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted to be reduced to a 1-hour fire-resistance rating.
2. For other than fire service access elevators and occupant evacuation elevators, in buildings four stories or less above grade plane where machine room, machinery spaces, control rooms and control spaces do not abut and do not have openings to the hoistway enclosure they serve, the machine room, machinery spaces, control rooms and control spaces are not required to be fire-resistance rated.

3005.4.1 Automatic sprinkler system. *Automatic sprinklers shall not be required to be installed in the elevator hoistway, elevator machine room, elevator machinery space, elevator control space or elevator control room where the following is met:*

The elevator machine room, elevator machinery space, elevator control space or elevator control room shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall not be less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors. The exceptions to Section 3005.4 shall not apply.

3005.5 Shunt trip. Where elevator hoistways, elevator machine rooms, control rooms and control spaces containing elevator control equipment are protected with automatic sprinklers, a means installed in accordance with Section 21.4 of NFPA 72 shall be provided to automatically disconnect the main line power supply to the affected elevator prior to the application of water. This means shall not be self-resetting. The activation of automatic sprinklers outside the hoistway, machine room, machinery space, control room or control space shall not disconnect the main line power supply.

3005.6 Plumbing systems. Plumbing systems shall not be located in elevator equipment rooms.

SECTION 3006—ELEVATOR LOBBIES AND HOISTWAY DOOR PROTECTION

3006.1 General. Enclosed elevator lobbies and elevator hoistway door protection shall be provided in accordance with the following:

1. Where elevator hoistway door protection is required by Section 3006.2, such protection shall be provided in accordance with Section 3006.3.
2. Where enclosed elevator lobbies are required for underground buildings, such lobbies shall comply with Section 405.4.3.
3. Where an area of refuge is required and an enclosed elevator lobby is provided to serve as an area of refuge, the enclosed elevator lobby shall comply with Section 1009.6.4.
4. Where fire service access elevators are provided, enclosed elevator lobbies shall comply with Section 3007.6.
5. Where occupant evacuation elevators are provided, enclosed elevator lobbies shall comply with Section 3008.6.

3006.2 Elevator hoistway door protection required. Elevator hoistway doors shall be protected in accordance with Section 3006.3 where an elevator hoistway connects more than *two stories in any state institution or other state-owned or specified state occupied building regulated by the Office of the State Fire Marshal, and more than three stories for all other buildings. Hoistway opening protection is* required to be enclosed within a shaft enclosure in accordance with Section 712.1.1 and any of the following conditions apply:

1. The building is not protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. *Group A occupancies.*
3. *Group E occupancies.*
4. *Group H occupancies.*
5. *Group I occupancies.*
6. *Group L occupancies.*
7. *Group R-1, R-2, R-2.1 and R-2.2 occupancies.*
8. *High-rise buildings.*
9. The elevator hoistway door is located in the wall of a corridor required to be fire-resistance rated in accordance with Section 1020.1.

See Section 403.6 for additional requirements for high-rise buildings.

Exceptions:

1. Protection of elevator hoistway doors is not required where the elevator serves only open parking garages in accordance with Section 406.5.
2. Protection of elevator hoistway doors is not required at the levels of exit discharge, provided that the levels of exit discharge is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.

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3. Protection of elevator hoistway doors is not required on levels where the elevator hoistway doors open to the exterior.

3006.2.1 Rated corridors. Where corridors are required to be fire-resistance rated in accordance with Section 1020.2, elevator hoistway openings shall be protected in accordance with Section 3006.3.

3006.3 Elevator hoistway door protection. Where Section 3006.2 requires protection of the elevator hoistway doors, the protection shall be provided by one of the following:

1. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway doors from each floor with fire partitions in accordance with Section 708. In addition, doors protecting openings in the fire partitions shall comply with Section 716.2.2.1. Penetrations of the fire partitions by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.
2. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway doors from each floor by smoke partitions in accordance with Section 710. In addition, doors protecting openings in the smoke partitions shall comply with Sections 710.5.2.2, 710.5.2.3 and 716.2.6.1. Penetrations of the smoke partitions by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.
3. Additional doors or other devices shall be provided at each elevator hoistway door in accordance with Section 3002.6. Such doors or other devices shall comply with the smoke and draft control door assembly requirements in Section 716.2.2.1.1 when tested in accordance with UL 1784 without an artificial bottom seal.
4. ***[SFM]*** *When approved, in other than Group I-2 occupancies elevator hoistway shall be pressurized in accordance with Section 909.21.*
5. A smoke-protective curtain assembly for hoistways shall be provided at each elevator hoistway door opening in accordance with Section 3002.6. Such curtain assemblies shall comply with the smoke and draft control requirements in Section 716.2.2.1.1 when tested in accordance with UL 1784 without an artificial bottom seal. Such curtain assemblies shall be equipped with a control unit listed to UL 864. Such curtain assemblies shall comply with Section 2.11.6.3 *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*. Installation and maintenance shall be in accordance with NFPA 105.
6. ***[SFM]*** *Enclosed elevator lobbies are not required where the hoistway door has a fire-protection rating as required by Section 707.6 and the hoistway door opening is also protected by a listed and labeled smoke containment system complying with ICC ES AC 77.*

3006.4 Means of egress. Elevator lobbies shall be provided with not less than one means of egress complying with Chapter 10 and other provisions in this code. Egress through an enclosed elevator lobby shall be permitted in accordance with Item 1 of Section 1016.2. Electrically locked exit access doors providing egress from elevator lobbies shall be permitted in accordance with Section 1010.2.14.

SECTION 3007—FIRE SERVICE ACCESS ELEVATOR

3007.1 General. Where required by Section 403.6.1, every floor above and including the lowest level of fire department vehicle access of the building shall be served by fire service access elevators complying with Sections 3007.1 through 3007.9. Except as modified in this section, fire service access elevators shall be installed in accordance with this chapter and *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

Exceptions:

1. *Below grade* parking garage *floors* shall not be required to *be served by* fire service access elevators.
2. The elevator shall not be required to serve the top floor of a building where that floor is utilized only for equipment for building systems.

3007.2 Automatic sprinkler system. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1 and as prohibited by Section 3007.2.1.

3007.2.1 Prohibited locations. Automatic sprinklers shall not be installed in machine rooms, elevator machinery spaces, control rooms, control spaces and elevator hoistways of fire service access elevators.

3007.2.2 Automatic sprinkler system monitoring. The automatic sprinkler system shall have a sprinkler control valve supervisory switch and water-flow-initiating device provided for each floor that is monitored by the building's fire alarm system.

3007.3 Water protection. Water from the operation of an automatic sprinkler system outside the enclosed lobby shall be prevented from infiltrating into the hoistway enclosure in accordance with an approved method.

3007.4 Shunt trip. Means for elevator shutdown in accordance with Section 3005.5 shall not be installed on elevator systems used for fire service access elevators.

3007.5 Hoistway enclosures. The fire service access elevator hoistway shall be located in a shaft enclosure complying with Section 713.

3007.5.1 Structural integrity of hoistway enclosures. The fire service access elevator hoistway enclosure shall comply with Sections 403.2.2.1 through 403.2.2.4.

3007.5.2 Hoistway lighting. When firefighters' emergency operation is active, the entire height of the hoistway shall be illuminated at not less than 1 footcandle (11 lux) as measured from the top of the car of each fire service access elevator.

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3007.6 Fire service access elevator lobby. The fire service access elevator shall open into an enclosed fire service access elevator lobby in accordance with Sections 3007.6.1 through 3007.6.5. Egress is permitted through the enclosed elevator lobby in accordance with Item 1 of Section 1016.2.

Exceptions:

1. Where a fire service access elevator has two entrances onto a floor, the second entrance shall be permitted to be protected in accordance with Section 3006.3.
2. A fire service access elevator lobby is not required to be provided at an occupiable roof.

3007.6.1 Access to *smokeproof enclosure*. The enclosed fire service access elevator lobby shall have direct access from the enclosed elevator lobby to a *smokeproof* enclosure *complying with Section 909.20.*

Exception: Access to *a smokeproof enclosure* shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.2.2.1.

3007.6.2 Elevator lobby separation. The fire service access elevator lobby shall be separated from each floor with a smoke barrier in accordance with Section 709, except that lobby doorways shall comply with Section 3007.6.3.

Exception: Fire service access elevator lobbies are not required to be separated at the levels of exit discharge.

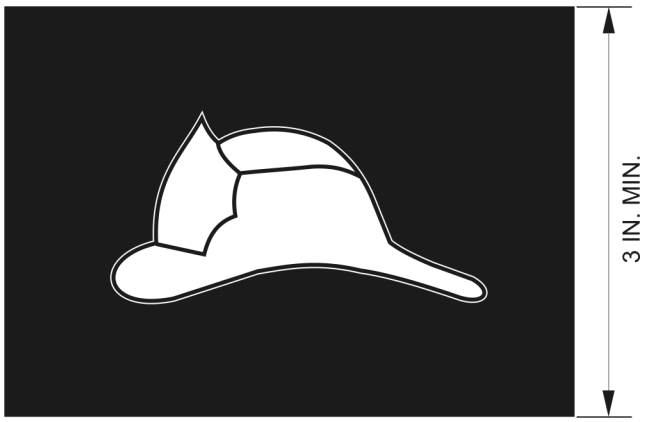
3007.6.3 Elevator lobby doorways. Other than doors to the elevator control room or elevator control space, each door in the smoke barrier shall be provided with a $^{3}/_{4}$-hour fire door assembly complying with Section 716. Such a fire door assembly shall comply with the smoke and draft control door assembly requirements of Section 716.2.2.1.1 and be tested in accordance with UL 1784 without an artificial bottom seal.

3007.6.4 Lobby size. Regardless of the number of fire service access elevators served by the same elevator lobby, the enclosed fire service access elevator lobby shall be not less than 150 square feet (14 m^2) in an area with a dimension of not less than 8 feet (2440 mm).

3007.6.5 Fire service access elevator symbol. A pictorial symbol of a standardized design designating which elevators are fire service access elevators shall be installed on each side of the hoistway door frame on the portion of the frame at right angles to the fire service access elevator lobby. The fire service access elevator symbol shall be designed as shown in Figure 3007.6.5 and shall comply with the following:

1. The fire service access elevator symbol shall be not less than 3 inches (76 mm) in height.
2. The helmet shall contrast with the background, with either a light helmet on a dark background or a dark helmet on a light background.
3. The vertical center line of the fire service access elevator symbol shall be centered on the hoistway door frame. Each symbol shall be not less than 78 inches (1981 mm), and not more than 84 inches (2134 mm) above the finished floor at the threshold.

FIGURE 3007.6.5—FIRE SERVICE ACCESS ELEVATOR SYMBOL



For SI: 1 inch = 25.4 mm.

3007.7 Elevator system monitoring. The fire service access elevator shall be continuously monitored at the fire command center by a standard emergency service interface system meeting the requirements of NFPA 72.

3007.8 Electrical power. The following features serving each fire service access elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator hoistway lighting.
3. Ventilation and cooling equipment for elevator machine rooms, control rooms, machine spaces and control spaces.
4. Elevator car lighting.

3007.8.1 Protection of wiring or cables. Wires or cables that are located outside of the elevator hoistway and machine room and that provide normal or standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to fire service access elevators shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 2 hours.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 2 hours.

Exception: Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operations.

3007.9 Standpipe hose connection. A Class I standpipe hose connection in accordance with Section 905 shall be provided in the interior exit stairway and ramp having direct access from the enclosed fire service access elevator lobby.

3007.9.1 Access. The exit enclosure containing the standpipe shall have access to the floor without passing through the enclosed fire service access elevator lobby.

SECTION 3008—OCCUPANT EVACUATION ELEVATORS

3008.1 General. *Where* elevators *are to be* used for occupant self-evacuation during fires*, all passenger elevators for general public use* shall comply with Sections 3008.1 through 3008.10. *Where other elevators are used for occupant self-evacuation, those elevators shall comply with these sections.*

3008.1.1 *Reserved*.

3008.1.2 Additional exit stairway. Where an additional means of egress is required in accordance with Section 403.5.2, an additional exit stairway shall not be required to be installed in buildings provided with occupant evacuation elevators complying with Section 3008.1.

3008.1.3 Fire safety and evacuation plan. The building shall have an approved fire safety and evacuation plan in accordance with the applicable requirements of Section 404 of the *California Fire Code*. The fire safety and evacuation plan shall incorporate specific procedures for the occupants using evacuation elevators.

3008.1.4 Operation. The occupant evacuation elevators shall be used for occupant self-evacuation in accordance with the occupant evacuation operation requirements in *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders,* and the building's fire safety and evacuation plan.

3008.2 Automatic sprinkler system. The building shall be equipped throughout with an approved, electrically supervised automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1 and as prohibited by Section 3008.2.1.

3008.2.1 Prohibited locations. Automatic sprinklers shall not be installed in elevator machine rooms, machinery spaces, control rooms, control spaces and elevator hoistways of occupant evacuation elevators *in accordance with this section and Section 3005.4.1.*

3008.2.2 Sprinkler system monitoring. The automatic sprinkler system shall have a sprinkler control valve supervisory switch and water-flow-initiating device provided for each floor that is monitored by the building's fire alarm system.

3008.3 Water protection. Water from the operation of an automatic sprinkler system outside the enclosed lobby shall be prevented from infiltrating into the hoistway enclosure in accordance with an approved method.

3008.4 Shunt trip. Means for elevator shutdown in accordance with Section 3005.5 shall not be installed on elevator systems used for occupant evacuation elevators.

3008.5 Hoistway enclosure protection. Occupant evacuation elevator hoistways shall be located in shaft enclosures complying with Section 713.

3008.5.1 Structural integrity of hoistway enclosures. Occupant evacuation elevator hoistway enclosures shall comply with Sections 403.2.2.1 through 403.2.2.4.

3008.6 Occupant evacuation elevator lobby. Occupant evacuation elevators shall open into an enclosed elevator lobby in accordance with Sections 3008.6.1 through 3008.6.6. Egress is permitted through the elevator lobby in accordance with Item 1 of Section 1016.2.

3008.6.1 Access to interior exit stairway or ramp. The occupant evacuation elevator lobby shall have direct access from the enclosed elevator lobby to an interior exit stairway or ramp.

Exceptions:

1. Access to an interior exit stairway or ramp shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.2.2.1.1.
2. Elevators that only service an open parking garage and the elevator lobby of the building shall not be required to provide direct access.

3008.6.2 Elevator lobby separation. The occupant evacuation elevator lobby shall be separated from each floor with a smoke barrier in accordance with Section 709, except that lobby doorways shall comply with Section 3008.6.3.

Exception: Occupant evacuation elevator lobbies are not required to be separated at the levels of exit discharge.

3008.6.3 Elevator lobby doorways. Other than the doors to elevator machine rooms, machinery spaces, control rooms and control spaces in the smoke barrier, each doorway to an occupant evacuation elevator lobby shall be provided with a $^3/_4$-hour fire door assembly complying with Section 716. Such a fire door assembly shall comply with the smoke and draft control assembly requirements of Section 716.2.2.1.1 and be tested in accordance with UL 1784 without an artificial bottom seal.

3008.6.3.1 Vision panel. A vision panel shall be installed in each fire door assembly in the smoke barrier. The vision panel shall consist of fire-protection-rated glazing, shall comply with the requirements of Section 716 and shall be located to furnish clear vision of the occupant evacuation elevator lobby.

3008.6.3.2 Door closing. Each fire door assembly in the smoke barrier shall be automatic-closing upon receipt of any fire alarm signal from the emergency voice/alarm communication system serving the building.

3008.6.4 Lobby size. Each occupant evacuation elevator lobby shall have minimum floor area as follows:

1. The occupant evacuation elevator lobby floor area shall accommodate, at 3 square feet (0.28 m^2) per person, not less than 25 percent of the occupant load of the floor area served by the lobby.
2. The occupant evacuation elevator lobby floor area shall accommodate one wheelchair space of 30 inches by 52 inches (760 mm by 1320 mm) for each 50 persons, or portion thereof, of the occupant load of the floor area served by the lobby.

Exception: The size of lobbies serving multiple banks of elevators shall have the minimum floor area approved on an individual basis and shall be consistent with the building's fire safety and evacuation plan.

3008.6.5 Signage. An approved sign indicating elevators are suitable for occupant self-evacuation shall be posted on all floors adjacent to each elevator call station serving occupant evacuation elevators.

3008.6.6 Two-way communication system. A two-way communication system shall be provided in each occupant evacuation elevator lobby for the purpose of initiating communication with the fire command center or an alternate location approved by the fire department. The two-way communication system shall be designed and installed in accordance with Sections 1009.8.1 and 1009.8.2.

3008.7 Elevator system monitoring. The occupant evacuation elevators shall be continuously monitored at the fire command center or a central control point approved by the fire department and arranged to display all of the following information:

1. Floor location of each elevator car.
2. Direction of travel of each elevator car.
3. Status of each elevator car with respect to whether it is occupied.
4. Status of normal power to the elevator equipment, elevator machinery and electrical apparatus cooling equipment where provided, elevator machine room, control room and control space ventilation and cooling equipment.
5. Status of standby or emergency power system that provides backup power to the elevator equipment, elevator machinery and electrical cooling equipment where provided, elevator machine room, control room and control space ventilation and cooling equipment.
6. Activation of any fire alarm initiating device in any elevator lobby, elevator machine room, machine space containing a motor controller or electric driving machine, control space, control room or elevator hoistway.

3008.7.1 Elevator recall. The fire command center or an alternate location approved by the fire department shall be provided with the means to manually initiate a Phase I Emergency Recall of the occupant evacuation elevators in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

3008.8 Electrical power. The following features serving each occupant evacuation elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Ventilation and cooling equipment for elevator machine rooms, control rooms, machinery spaces and control spaces.
3. Elevator car lighting.

3008.8.1 Determination of standby power load. Standby power loads shall be based on the determination of the number of occupant evacuation elevators in Section 3008.1.1.

3008.8.2 Protection of wiring or cables. Wires or cables that are located outside of the elevator hoistway, machine room, control room and control space and that provide normal or standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to occupant evacuation elevators shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 2 hours.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 2 hours.

Exception: Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operation.

3008.9 Emergency voice/alarm communication system. The building shall be provided with an emergency voice/alarm communication system. The emergency voice/alarm communication system shall be accessible to the fire department. The system shall be provided in accordance with Section 907.5.2.2.

3008.9.1 Notification appliances. Not fewer than one audible and one visible notification appliance shall be installed within each occupant evacuation elevator lobby.

3008.10 Hazardous material areas. Building areas shall not contain hazardous materials exceeding the maximum allowable quantities per control area as addressed in Section 414.2.

SECTION 3009—PRIVATE RESIDENCE ELEVATORS

3009.1 General. The design, construction and installation of elevators installed within a residential dwelling unit or installed to provide access to one individual residential dwelling unit shall conform to *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

3009.2 Hoistway enclosures. Hoistway enclosures shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

3009.3 Hoistway opening protection. Hoistway landing doors for private residence elevators shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

SECTION 3010—SPECIAL REQUIREMENTS FOR ELEVATORS IN HOSPITALS

3010.1 General. [OSHPD 1] *In hospital buildings, all elevators shall comply with the provisions of this section.*

3010.1.1 Seismic switch. *The seismic switch, as required by ASME A17.1, shall be connected to the essential electrical system.*

3010.1.2 Annunciator. *Either a visible or an audible annunciator shall be connected to the essential electrical system and be located in the elevator machine room. The annunciator will indicate if the seismic switch is inoperative due to a loss of power. If a visual annunciator is used, it shall be clearly visible in the room.*

3010.1.3 Travel speed. *After a seismic switch has been triggered, the elevator shall have the ability to operate at a "go slow" speed until the elevator can be inspected. "Go slow" speed is defined as a travel speed of not more than 150 feet per minute (45.72 meters per minute).*

3010.1.4 Cable-operated elevators. *For cable-operated elevators, an additional sensor switch shall be installed on the governor rope/sheave. The sensor shall prevent car movement when the governor tail sheave is dislodged from its normal position.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 31 – SPECIAL CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter										**X**	**X**	**X**	**X**	**X**	**X**	**X**								
Adopt entire chapter as amended (amended sections listed below)				**X**	**X**			**X**	**X**															
Adopt only those sections that are listed below	**X**		**X**			**X**	**X**																	
Chapter / Section																								
3101			X																					
3102			X																					
3103			X																					
3103.1								X	X															
3104			X																					
3104.2, *Exception 2*						X	X																	
3105			X																					
3106			X																					
3109				†	†																			
3109.1								X	X															
3109.2, Note	X																							
3110			X																					
3111			X																					
3111.1.1, *Exception*				X	X			X	X															
3112.2				X																				
3112.3, *Exception*								X	X															
3113				†	†																			
3113.1				X	X			X	X															
3113.1.1								X	X															
3113.2, *Exception*								X	X															
3113.3, *Exception*								X	X															
3113.4, *Exception*								X	X															
3114			X							†	†	†		†	†									
3114.1, Exceptions				X	X			X	X															
3114.6, Exception								X	X															
3114.8.4.2								X	X															
3114.8.5								X	X															
3114.9								X	X															

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

31

SPECIAL CONSTRUCTION

User notes:

About this chapter:	Chapter 31 provides regulations for unique buildings and building elements. Those include buildings such as membrane structures, greenhouses and relocatable buildings. Special elements include pedestrian walkways and tunnels, awnings, canopies and marquees, vehicular gates, solar energy systems, public use restrooms in flood hazard areas, and intermodal shipping containers.
ICC code development note:	Code development reminder: Code change proposals to sections preceded by the designation [F] and [BE] will be considered by a code development committee meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2025 (Group B) Code Development Cycle.

SECTION 3101—GENERAL

3101.1 Scope. The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, awnings and canopies, marquees, signs, telecommunications and broadcast towers, swimming pools, spas and hot tubs, automatic vehicular gates, solar energy systems, greenhouses, relocatable buildings and intermodal shipping containers.

SECTION 3102—MEMBRANE STRUCTURES

3102.1 General. The provisions of Sections 3102.1 through 3102.8 shall apply to air-supported, air-inflated, membrane-covered cable, membrane-covered frame and tensile membrane structures, collectively known as membrane structures, erected for a period of 180 days or longer. Those erected for a shorter period of time shall comply with the *California Fire Code*. Membrane structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants, greenhouses and similar facilities not used for human occupancy are required to meet only the requirements of Sections 3102.3.1 and 3102.7. Membrane structures erected on a building, balcony, deck or other structure for any period of time shall comply with this section.

3102.2 Tensile membrane structures and air-supported structures. Tensile membrane structures and air-supported structures, including permanent and temporary structures, shall be designed and constructed in accordance with ASCE 55. The provisions in Sections 3102.3 through 3102.6 shall apply.

3102.3 Type of construction. Noncombustible membrane structures shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IV-HT construction. Other membrane structures shall be classified as Type V construction.

Exception: Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

3102.3.1 Membrane and interior liner material. Membranes and interior liners shall be either noncombustible as set forth in Section 703.3 *shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8. Tops and sidewalls shall be made either from fabric that has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame resistant fabric approved and listed by the State Fire Marshal (see CCR, Title 19, Division 1, Chapter 8).*

Exception: Plastic less than 20 mil (0.5 mm) in thickness used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

3102.4 Allowable floor areas. The area of a membrane structure shall not exceed the limitations specified in Section 506.

3102.5 Maximum height. Membrane structures shall not exceed one story nor shall such structures exceed the height limitations in feet specified in Section 504.3.

Exception: Noncombustible membrane structures serving as roofs only.

3102.6 Mixed construction. Membrane structures shall be permitted to be utilized as specified in this section as a portion of buildings of other types of construction. Height and area limits shall be as specified for the type of construction and occupancy of the building.

3102.6.1 Noncombustible membrane. A noncombustible membrane shall be permitted for use as the roof or as a skylight of any building or atrium of a building of any type of construction provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

3102.6.1.1 Membrane. A membrane meeting the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 shall be permitted to be used as the roof or as a skylight on buildings of Type IIB, III, IV-HT and V construction, provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

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3102.7 Engineering design. The structure shall be designed and constructed to sustain dead loads; loads due to tension or inflation; live loads including wind, snow or flood and seismic loads and in accordance with Chapter 16.

3102.7.1 Lateral restraint. For membrane-covered frame structures, the membrane shall not be considered to provide lateral restraint in the calculation of the capacities of the frame members.

3102.8 Inflation systems. Air-supported and air-inflated structures shall be provided with primary and auxiliary inflation systems to meet the minimum requirements of Sections 3102.8.1 through 3102.8.3.

3102.8.1 Equipment requirements. The inflation system shall consist of one or more blowers and shall include provisions for automatic control to maintain the required inflation pressures. The system shall be so designed as to prevent overpressurization of the system.

3102.8.1.1 Auxiliary inflation system. In addition to the primary inflation system, in buildings larger than 1,500 square feet (140 m^2) in area, an auxiliary inflation system shall be provided with sufficient capacity to maintain the inflation of the structure in case of primary system failure. The auxiliary inflation system shall operate automatically when there is a loss of internal pressure and when the primary blower system becomes inoperative.

3102.8.1.2 Blower equipment. Blower equipment shall meet all of the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required for any flow condition as required by the structural design.
2. Blowers shall be provided with inlet screens, belt guards and other protective devices as required by the building official to provide protection from injury.
3. Blowers shall be housed within a weather-protecting structure.
4. Blowers shall be equipped with backdraft check dampers to minimize air loss when inoperative.
5. Blower inlets shall be located to provide protection from air contamination. The location of inlets shall be approved.

3102.8.2 Standby power. Wherever an auxiliary inflation system is required, an approved standby power-generating system shall be provided. The system shall be equipped with a suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all of the required electrical functions at full power within 60 seconds of such service failure. Standby power shall be capable of operating independently for not less than 4 hours.

3102.8.3 Support provisions. A system capable of supporting the membrane in the event of deflation shall be provided for in air-supported and air-inflated structures having an occupant load of 50 or more or where covering a swimming pool regardless of occupant load. The support system shall be capable of maintaining membrane structures used as a roof for Type I construction not less than 20 feet (6096 mm) above floor or seating areas. The support system shall be capable of maintaining other membranes not less than 7 feet (2134 mm) above the floor, seating area or surface of the water.

SECTION 3103—TEMPORARY STRUCTURES

3103.1 General. The provisions of Sections 3103.1 through 3103.8 shall apply to structures erected for a period of less than 180 days. Temporary special event structures, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the *California Fire Code*. Temporary structures erected for a longer period of time and public-occupancy temporary structures shall comply with applicable sections of this code.

Exceptions:

1. Public-occupancy temporary structures complying with Section 3103.1.1 shall be permitted to remain in service for 180 days or more but not more than 1 year where approved by the building official.
2. Public-occupancy temporary structures within the confines of an existing structure are not required to comply with Section 3103.6.

[DSA-SS, DSA-SS/CC] *The classification of public-occupancy temporary structure shall not be applied to any school building as defined in Section 4-314 of the California Administrative Code.*

3103.1.1 Extended period of service time. Public-occupancy temporary structures shall be permitted to remain in service for 180 days or more without complying with requirements in this code for new building or structures where extensions for up to 1 year are granted by the Building Official in accordance with Section 108.1 and where the following conditions are satisfied:

1. Additional inspections as determined by the building official shall be performed by a qualified person to verify that site conditions and the approved installation comply with the conditions of approval at the time of final inspection.
2. A qualified person shall perform follow-up inspections after initial occupancy at intervals not exceeding 180 days to verify the site conditions and the installation conform to the approved site conditions and installation requirements. Inspection records shall be kept and shall be made available for verification by the building official.
3. An examination shall be performed by a registered design professional to determine the adequacy of the temporary structure to resist the structural loads required in Section 3103.6.
4. Relocation of the public-occupancy temporary structure shall require a new permit application.
5. The use or occupancy approved at the time of final inspection shall remain unchanged.

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6. A request for an extension is submitted to the building official. The request shall include records of the inspections and examination in Items 1 and 3.

3103.1.2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

3103.1.2.1 Water-filled vessels. [SFM] *Water-filled vessels shall not be used to anchor a tent or membrane structure unless approved and in accordance with the tent or membrane structure manufacturer's instructions.*

3103.1.3 Permit required. Temporary structures that cover an area greater than 120 square feet (11.16 m^2), including connecting areas or spaces with a common means of egress or entrance that are used or intended to be used for the gathering together of 10 or more persons, shall not be erected, operated or maintained for any purpose without obtaining a permit from the building official.

3103.2 Construction documents. A permit application and construction documents shall be submitted for each installation of a temporary structure. The construction documents, shall include a site plan indicating the location of the temporary structure and information delineating the means of egress and the occupant load.

3103.3 Location. Temporary structures shall be located in accordance with the requirements of Table 705.5 based on the fire-resistance rating of the exterior walls for the proposed type of construction.

3103.4 Means of egress. Temporary structures shall conform to the means of egress requirements of Chapter 10 and shall have an exit access travel distance of 100 feet (30 480 mm) or less.

3103.5 Bleachers. Temporary bleachers, grandstands and folding and telescopic seating that are not building elements shall comply with ICC 300.

3103.6 Structural requirements. Temporary structures shall comply with the structural requirements of this code. Public-occupancy temporary structures shall be designed and erected to comply with the structural requirements of this code and Sections 3103.6.1 through 3103.6.4.

Exception: Where approved, live loads less than those prescribed by Table 1607.1 shall be permitted provided that a registered design professional demonstrates that a rational approach has been used and that such reductions are warranted.

Temporary non-building structures ancillary to public assemblies or special event structures whose structural failure or collapse would endanger assembled public shall be assigned a risk category corresponding to the risk category of the public assembly. For the purposes of establishing an occupant load for the assembled public endangered by structural failure or collapse, the applicable occupant load determination in Section 1004.5 or 1004.6 shall be applied over the assembly area within a radius equal to 1.5 times the height of the temporary non-building structure

3103.6.1 Structural loads. Public-occupancy temporary structures shall be designed in accordance with Chapter 16, except as modified by Sections 3103.6.1.1 through 3103.6.1.6.

3103.6.1.1 Snow loads. Snow loads on public-occupancy temporary structures shall be determined in accordance with Section 1608. The ground snow loads, p_g, in Section 1608 shall be modified according to Table 3103.6.1.1.

Exception: Ground snow loads, p_g, for public-occupancy temporary structures that employ controlled-occupancy procedures per Section 3103.8 shall be permitted to be modified using a ground snow load reduction factor of 0.65 instead of the ground snow load reduction factors in Table 3103.6.1.1.

Where the public-occupancy temporary structure is not subject to snow loads or not constructed and occupied during times when snow is to be expected, snow loads need not be considered, provided that where the period of time when the public-occupancy temporary structure is in service shifts to include times when snow is to be expected, one of the following conditions is met:

1. The design is reviewed and modified, as appropriate, to account for snow loads.
2. Controlled occupancy procedures in accordance with Section 3103.8 are implemented.

TABLE 3103.6.1.1—REDUCTION FACTORS FOR GROUND SNOW LOADS FOR PUBLIC-OCCUPANCY TEMPORARY STRUCTURES

RISK CATEGORY	SERVICE LIFE	
	≤ 10 yr	>10 yr
II	0.7	1.0
III	0.8	1.0
IV	1.0	1.0

3103.6.1.2 Wind loads. The design wind load on public-occupancy temporary structures shall be permitted to be modified in accordance with the wind load reduction factors in Table 3103.6.1.2.

Exceptions:

1. Design wind loads for public-occupancy temporary structures that implement controlled occupancy procedures per Section 3103.8 shall be permitted to be modified using a wind load reduction factor of 0.65.

2. For public-occupancy temporary structures erected in a hurricane-prone region outside of hurricane season, the basic wind speed, V, shall be permitted to be set as follows, depending on risk category:
   2.1. Risk Category II: 115 mph.
   2.2. Risk Category III: 120 mph.
   2.3. Risk Category IV: 125 mph.

TABLE 3103.6.1.2—REDUCTION FACTORS FOR WIND LOADS FOR PUBLIC-OCCUPANCY TEMPORARY STRUCTURES

RISK CATEGORY	SERVICE LIFE	
	≤ 10 yr	>10 yr
II	0.8	1.0
III	0.9	1.0
IV	1.0	1.0

3103.6.1.3 Flood loads. Public-occupancy temporary structures need not be designed for flood loads specified in Section 1612. Controlled occupancy procedures in accordance with Section 3103.8 shall be implemented.

3103.6.1.4 Seismic loads. Seismic loads on public-occupancy temporary structures assigned to Seismic Design Categories C through F shall be permitted to be taken as 75 percent of those determined by Section 1613. Public-occupancy temporary structures assigned to Seismic Design Categories A and B are not required to be designed for seismic loads.

3103.6.1.5 Ice loads. Ice loads on public-occupancy temporary structures shall be permitted to be determined with a maximum nominal thickness of 0.5 inch (13 mm), for all risk categories. Where the public-occupancy temporary structure is not subject to ice loads or not constructed and occupied during times when ice is to be expected, ice loads need not be considered, provided that where the period of time when the public-occupancy temporary structure is in service shifts to include times when ice is to be expected, one of the following conditions is met:

1. The design is reviewed and modified, as appropriate, to account for ice loads.
2. Controlled occupancy procedures in accordance with Section 3103.8 are implemented.

3103.6.1.6 Tsunami loads. Public-occupancy temporary structures in a tsunami design zone are not required to be designed for tsunami loads specified in Section 1615. Controlled occupancy procedures in accordance with Section 3103.8 shall be implemented.

3103.6.2 Foundations. Public-occupancy temporary structures shall be permitted to be supported on the ground with temporary foundations where approved by the building official. Consideration shall be given for the impacts of differential settlement where foundations do not extend below the ground or where foundations are supported on compressible materials. The presumptive load-bearing value for public-occupancy temporary structures supported on a pavement, slab on grade or on other collapsible or controlled low-strength substrate soils such as beach sand or grass shall be assumed not to exceed 1,000 pounds per square foot (47.88 kPa) unless determined through testing and evaluation by a registered design professional. The presumptive load-bearing values listed in Table 1806.2 shall be permitted to be used for other supporting soil conditions.

3103.6.3 Installation and maintenance inspections. A qualified person shall inspect public-occupancy temporary structures that are assembled using transportable and reusable materials. Components shall be inspected when purchased or acquired and at least once per year. The inspection shall evaluate individual components, and the fully assembled structure, to determine suitability for use based on the requirements in ESTA ANSI E1.21. Inspection records shall be kept and shall be made available for verification by the building official. Additionally, public-occupancy temporary structures shall be inspected at regular intervals when in service to ensure that the structure continues to perform as designed and initially erected.

3103.6.4 Durability. Reusable components used in the erection and the installation of public-occupancy temporary structures shall be manufactured of durable materials necessary to withstand environmental conditions at the service location. Components damaged during transportation or installation or due to the effects of weathering shall be replaced or repaired.

3103.7 Serviceability. The effects of structural loads or conditions shall not adversely affect the serviceability or performance of the public-occupancy temporary structure.

3103.8 Controlled occupancy procedures. Where controlled occupancy procedures are required to be implemented for public-occupancy temporary structures in Section 3103.6.1, the procedures shall comply with this section and ANSI ES1.7. An operations management plan in accordance with ANSI E1.21 shall be submitted to the building official for approval as a part of the permit documents. In addition, the operations management plan shall include an emergency action plan that documents the following information, where applicable:

1. Surfaces on which snow or ice accumulates shall be monitored before and during occupancy of the public-occupancy temporary structure. Any loads in excess of the design snow or ice load shall be removed prior to its occupancy, or the public-occupancy temporary structure shall be vacated in the event that either the design snow or ice load is exceeded during its occupancy.

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2. Wind speeds associated with the design wind loads shall be monitored before and during occupancy of the public-occupancy temporary structure. The public-occupancy temporary structure shall be vacated in the event that the design wind speed is expected to be exceeded during its occupancy.
3. Criteria for initiating occupant evacuation procedures for flood and tsunami events.
4. Occupant evacuation procedures shall be specified for each environmental hazard where the occupant management plan specifies the public-occupancy temporary structure is to be evacuated.
5. Procedures for anchoring or removal of the public-occupancy temporary structure, or other additional measures or procedures to be implemented to mitigate hazards in snow, wind, flood, ice or tsunami events.

SECTION 3104—PEDESTRIAN WALKWAYS AND TUNNELS

3104.1 General. This section shall apply to connections between buildings such as pedestrian walkways or tunnels, located at, above or below grade level, that are used as a means of travel by persons. The pedestrian walkway shall not contribute to the building area or the number of stories or height of connected buildings.

3104.1.1 Application. Pedestrian walkways shall be designed and constructed in accordance with Sections 3104.2 through 3104.9. Tunnels shall be designed and constructed in accordance with Sections 3104.2 and 3104.10.

3104.2 Separate structures. Buildings connected by pedestrian walkways or tunnels shall be considered to be separate structures.

Exceptions:

1. Buildings that are on the same lot and considered as portions of a single building in accordance with Section 503.1.2.
2. ***[DSA-AC and HCD 1-AC]*** *For purposes of accessibility in residential facilities as required by Chapters 11A and 11B, structurally connected buildings, buildings connected by stairs, walkways or roofs, and buildings with multiple wings shall be considered one structure.*

3104.3 Construction. The pedestrian walkway shall be of noncombustible construction.

Exceptions:

1. Combustible construction shall be permitted where connected buildings are of combustible construction.
2. Fire-retardant-treated wood, in accordance with Section 603.1, Item 1.3, shall be permitted for the roof construction of the pedestrian walkway where connected buildings are not less than Type I or II construction.

3104.4 Contents. Only materials and decorations approved by the building official shall be located in the pedestrian walkway.

3104.5 Connections of pedestrian walkways to buildings. The connection of a pedestrian walkway to a building shall comply with Section 3104.5.1, 3104.5.2, 3104.5.3 or 3104.5.4.

Exception: Buildings that are on the same lot and considered as portions of a single building in accordance with Section 503.1.2.

3104.5.1 Fire barriers. Pedestrian walkways shall be separated from the interior of the building by not less than 2-hour fire barriers constructed in accordance with Section 707 and Sections 3104.5.1.1 through 3104.5.1.3.

3104.5.1.1 Exterior walls. Exterior walls of buildings connected to pedestrian walkways shall be 2-hour fire-resistance rated. This protection shall extend not less than 10 feet (3048 mm) in every direction surrounding the perimeter of the pedestrian walkway.

3104.5.1.2 Openings in exterior walls of connected buildings. Openings in exterior walls required to be fire-resistance rated in accordance with Section 3104.5.1.1 shall be equipped with opening protectives providing a not less than $^{3}/_{4}$-hour fire protection rating in accordance with Section 716.

3104.5.1.3 Supporting construction. The fire barrier shall be supported by construction as required by Section 707.5.1.

3104.5.2 Alternative separation. The wall separating the pedestrian walkway and the building shall comply with Section 3104.5.2.1 or 3104.5.2.2 where:

1. The distance between the connected buildings is more than 10 feet (3048 mm).
2. The pedestrian walkway and connected buildings are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, and the roof of the walkway is not more than 55 feet (16 764 mm) above grade connecting to the fifth, or lower, story above grade plane, of each building.

Exception: Open parking garages need not be equipped with an automatic sprinkler system.

3104.5.2.1 Passage of smoke. The wall shall be capable of resisting the passage of smoke.

3104.5.2.2 Glass. The wall shall be constructed of a tempered, wired or laminated glass and doors separating the interior of the building from the pedestrian walkway. The glass shall be protected by an automatic sprinkler system in accordance with Section 903.3.1.1 that, when actuated, shall completely wet the entire surface of interior sides of the wall or glass. Obstructions shall not be installed between the sprinkler heads and the wall or glass. The glass shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler operates.

3104.5.3 Open sides on walkway. Where the distance between the connected buildings is more than 10 feet (3048 mm), the walls at the intersection of the pedestrian walkway and each building need not be fire-resistance rated provided that both sidewalls of the pedestrian walkway are not less than 50 percent open with the open area uniformly distributed to prevent the

accumulation of smoke and toxic gases. The roof of the walkway shall be located not more than 40 feet (12 160 mm) above grade plane, and the walkway shall only be permitted to connect to the third or lower story of each building.

Exception: Where the pedestrian walkway is protected with an automatic sprinkler system in accordance with Section 903.3.1.1, the roof of the walkway shall be located not more than 55 feet (16 764 mm) above grade plane and the walkway shall only be permitted to connect to the fifth or lower story of each building.

3104.5.4 Exterior walls greater than 2 hours. Where exterior walls of connected buildings are required by Section 705 to have a fire-resistance rating greater than 2 hours, the walls at the intersection of the pedestrian walkway and each building need not be fire-resistance rated provided:

1. The pedestrian walkway is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. The roof of the walkway is not located more than 55 feet (16 764 mm) above grade plane and the walkway connects to the fifth, or lower, story above grade plane of each building.

3104.6 Public way. Pedestrian walkways over a public way shall comply with Chapter 32.

[BE] 3104.7 Egress. Access shall be provided at all times to a pedestrian walkway that serves as a required exit.

[BE] 3104.8 Width. The unobstructed width of pedestrian walkways shall be not less than 36 inches (914 mm). The total width shall be not greater than 30 feet (9144 mm).

[BE] 3104.9 Exit access travel. The length of exit access travel shall be 200 feet (60 960 mm) or less.

Exceptions:

1. Exit access travel distance on a pedestrian walkway equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be 250 feet (76 200 mm) or less.
2. Exit access travel distance on a pedestrian walkway constructed with both sides not less than 50 percent open shall be 300 feet (91 440 mm) or less.
3. Exit access travel distance on a pedestrian walkway constructed with both sides not less than 50 percent open, and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, shall be 400 feet (122 m) or less.

3104.10 Tunneled walkway. Separation between the tunneled walkway and the building to which it is connected shall be not less than 2-hour fire-resistant construction and openings therein shall be protected in accordance with Section 716.

SECTION 3105—AWNINGS AND CANOPIES

3105.1 General. Awnings and canopies shall comply with the requirements of Sections 3105.2 and 3105.3 and other applicable sections of this code.

3105.2 Design and construction. Awnings and canopies shall be designed and constructed to withstand wind or other lateral loads and live loads as required by Chapter 16 with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration. Awnings shall have frames of noncombustible material, fire-retardant-treated wood, heavy timber complying with Section 2304.11 or 1-hour construction, and shall be fixed, retractable, folding or collapsible.

3105.3 Awnings and canopy materials. Awnings and canopies shall be provided with an approved covering that complies with one of the following:

1. The fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
2. Has a flame spread index not greater than 25 when tested in accordance with ASTM E84 or UL 723.
3. Meets all of the following criteria when tested in accordance with NFPA 286:
    3.1. During the 40 kW exposure, flames shall not spread to the ceiling.
    3.2. Flashover, as defined in NFPA 286, shall not occur.
    3.3. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
    3.4. The peak heat release rate throughout the test shall not exceed 800 kW.

All fabrics and all interior decorative fabrics or materials shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8. Tops and sidewalls shall be made either from fabric that has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame resistant fabric approved and listed by the State Fire Marshal (see CCR, Title 19, Division 1, Chapter 8).

Exception: The fire propagation performance and flame spread index requirements shall not apply to awnings installed on detached one- and two-family dwellings.

SECTION 3106—MARQUEES

3106.1 General. Marquees shall comply with Sections 3106.2 through 3106.5 and other applicable sections of this code.

3106.2 Thickness. The height or thickness of a marquee measured vertically from its lowest to its highest point shall be not greater than 3 feet (914 mm) where the marquee projects more than two-thirds of the distance from the lot line to the curb line, and shall be not greater than 9 feet (2743 mm) where the marquee is less than two-thirds of the distance from the lot line to the curb line.

3106.3 Roof construction. Where the roof or any part thereof is a skylight, the skylight shall comply with the requirements of Chapter 24. Every roof and skylight of a marquee shall be sloped to downspouts that shall conduct any drainage from the marquee in such a manner so as not to spill over the sidewalk.

3106.4 Location prohibited. Every marquee shall be so located as not to interfere with the operation of any exterior standpipe, and such that the marquee does not obstruct the clear passage of stairways or exit discharge from the building or the installation or maintenance of street lighting.

3106.5 Construction. A marquee shall be supported entirely from the building and constructed of noncombustible materials. Marquees shall be designed as required in Chapter 16. Structural members shall be protected to prevent deterioration.

SECTION 3107—SIGNS

3107.1 General. Signs shall be designed, constructed and maintained in accordance with this code.

SECTION 3108—TELECOMMUNICATION AND BROADCAST TOWERS

[BS] 3108.1 General. Towers shall be designed and constructed in accordance with the provisions of TIA 222. Towers shall be designed for seismic loads; exceptions related to seismic design listed in Section 2.7.3 of TIA 222 shall not apply. In Section 2.6.6.2 of TIA 222, the horizontal extent of Topographic Category 2, escarpments, shall be 16 times the height of the escarpment.

Exception: Single free-standing poles used to support antennas not greater than 75 feet (22 860 mm), measured from the top of the pole to grade, shall not be required to be noncombustible.

[BS] 3108.2 Location and access. Towers shall be located such that guy wires and other accessories shall not cross or encroach on any street or other public space, or over above-ground electric utility lines, or encroach on any privately owned property without the written consent of the owner of the encroached-upon property, space or above-ground electric utility lines. Towers shall be equipped with climbing and working facilities in compliance with TIA 222. Access to the tower sites shall be limited as required by applicable OSHA, FCC and EPA regulations.

SECTION 3109—SWIMMING POOLS, SPAS AND HOT TUBS

3109.1 General. The design and construction of swimming pools, spas and hot tubs shall comply with *this code*. ***[DSA-SS and DSA-SS/CC]*** *Swimming pools utilized for public school purposes shall also be designed, constructed and inspected in accordance with this code.*

3109.2 California swimming pool safety act (statewide).

NOTE: These regulations are subject to local government modification. You should verify the applicable local government requirements at the time of application for a building permit.

The following text in this section contains the statutory language in the Swimming Pool Safety Act (HS Code, §§ 115920 – 115929) that is required to be duplicated and published in California Code of Regulations, Title 24. As such, the section numbers reflect those within the Health and Safety Code.

115920. *This act shall be known and may be cited as the Swimming Pool Safety Act.*

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115921. *As used in this article the following terms have the following meanings:*

(a) "Swimming pool" or "pool" means any structure intended for swimming or recreational bathing that contains water over 18 inches deep. "Swimming pool" includes in-ground and aboveground structures and includes, but is not limited to, hot tubs, spas, portable spas and nonportable wading pools.

(b) "Public swimming pool" means a swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a private club. Public swimming pool does not include a swimming pool located on the grounds of a private single-family home.

(c) "Enclosure" means a fence, wall or other barrier that isolates a swimming pool from access to the home.

(d) "ANSI/APSP performance standard" means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).

(e) "Suction outlet" means a fitting or fixture typically located at the bottom or on the sides of a swimming pool that conducts water to a recirculating pump.

[Amended by Stats. 2024, Ch 769 (SB 552) Effective January 1, 2025.]

115922*. (a) Except as provided in Section 115925, subject to subdivision (b), and consistent with Section 1596.814, when a building permit is issued for the construction of a new swimming pool or spa or the remodeling of an existing swimming pool or spa at a private single-family home, the respective swimming pool or spa shall be equipped with at least two of the following seven drowning prevention safety features:*

(1) An enclosure that meets the requirements of Section 115923 and isolates the swimming pool or spa from the private single-family home.

(2) Removable mesh fencing that meets the ASTM International F2286 standard in conjunction with a gate that is self-closing and self-latching and can accommodate a key lockable device.

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(3) A manually operated or power-operated safety pool cover that is accompanied by a label verifying that the cover meets the specifications of the ASTM International F1346-23 standard.

(4) Exit alarms on the private single-family home's doors and windows that provide direct access to the swimming pool or spa without any intervening enclosure. Whenever any door or window is opened or left ajar, exit alarms shall make either an audible, continuous alarm sound or a repeating verbal warning, such as a notification that "the door to the pool is open." An exit alarm may be battery operated or connected to the electrical wiring of the building.

(5) A self-closing, self-latching device with a release mechanism placed no lower than 54 inches above the floor on the private single-family home's doors providing direct access to the swimming pool or spa.

(6) An alarm in good repair and operable as designed that, when placed in a swimming pool or spa, will sound upon detection of accidental or unauthorized entrance into the water. The alarm shall meet and be independently certified to the ASTM International F2208 standard that includes surface motion, pressure, sonar, laser and infrared type alarms. A swimming protection alarm feature designed for individual use, including an alarm attached to a child that sounds when the child exceeds a certain distance or becomes submerged in water, is not a qualifying drowning prevention safety feature.

(7) Other means of protection, if the degree of protection afforded is equal to or greater than that afforded by any of the features set forth above and has been independently verified by an approved testing laboratory as meeting standards for those features established by ASTM International, the American Society of Mechanical Engineers, or another nationally recognized standards development organization, and the feature is accompanied by a label verifying that the protection meets those standards.

(b) The requirements of subdivision (a) are not satisfied by any of the following:

(1) An exit alarm and a self-closing, self-latching device on the same door.

(2) An exit alarm and a door latch on separate doors.

(3) A safety pool cover and an alarm described in paragraph (6) of subdivision (a).

(c) Before the issuance of a final approval for the completion of permitted construction or remodeling work, the local building code official shall inspect the drowning safety prevention features required by this section and, if no violations are found, shall give final approval.

[Amended by Stats. 2024, Ch. 745 (AB 2866) and Ch 769 (SB 552) Effective January 1, 2025.]

115923. *An enclosure shall have all of the following characteristics:*

(a) Any access gates through the enclosure open away from the swimming pool, and are self-closing with a self-latching device placed no lower than 60 inches above the ground.

(b) A minimum height of 60 inches.

(c) A maximum vertical clearance from the ground to the bottom of the enclosure of two inches.

(d) Gaps or voids, if any, do not allow passage of a sphere equal to or greater than four inches in diameter.

(e) An outside surface free of protrusions, cavities or other physical characteristics that would serve as handholds or footholds that could enable a child below the age of five years to climb over.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115924. *(a) Any person entering into an agreement to build a swimming pool or spa, or to engage in permitted work on a pool or spa covered by this article, shall give the consumer notice of the requirements of this article.*

(b) Pursuant to existing law, the Department of Health Services shall have available on the department's Web site, commencing January 1, 2007, approved pool safety information available for consumers to download. Pool contractors are encouraged to share this information with consumers regarding the potential dangers a pool or spa poses to toddlers. Additionally, pool contractors may provide the consumer with swimming pool safety materials produced from organizations such as the United States Consumer Product Safety Commission, Drowning Prevention Foundation, California Coalition for Children's Safety & Health, Safe Kids Worldwide, Association of Pool and Spa Professionals, or the American Academy of Pediatrics.

(Amended by Stats. 2006, Ch. 478, Sec. 3. Effective January 1, 2007.)

115925. *The requirements of this article do not apply to any of the following:*

(a) Public swimming pools.

(b) Hot tubs or spas with locking safety covers that comply with the ASTM International F1346 standard.

(c) An apartment complex or any residential setting other than a single-family home.

[Amended by Stats. 2024, Ch. 769 (SB 552) Effective January 1, 2025.]

115926 *(a) The State Department of Social Services shall prescribe drowning prevention safety standards governing all swimming pools and other bodies of water located at facilities regulated by the department, regardless of whether the swimming pool is also subject to this article. The department may adopt higher drowning prevention safety standards than the requirements of this article. The department shall adopt regulations required by this section by January 1, 2027.*

(b) Notwithstanding the rulemaking provisions of the Administrative Procedure Act [Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code], the State Department of Social Services may implement, interpret, or make specific this article by means of interim licensing standards or similar written instructions until regulations are

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adopted. These interim licensing standards or similar written instructions shall have the same force and effect as regulations until January 1, 2027.

[Added by Stats. 2024, Ch. 745 (AB 2866) Effective January 1, 2025.]

115927. *Notwithstanding any other provision of law, this article shall not be subject to further modification or interpretation by any regulatory agency of the state, this authority being reserved exclusively to local jurisdictions, as provided for in paragraph (7) subdivision (a) of Section 115922 and subdivision (c) of Section 115925.*

[Amended by Stats. 2018, Ch. 957, Sec. 13. (SB 1078) Effective January 1, 2019.]

115928. *Whenever a building permit is issued for the construction of a new swimming pool or spa, the pool or spa shall meet all of the following requirements:*

(a) (1) The suction outlets of the pool or spa for which the permit is issued shall be equipped to provide circulation throughout the pool or spa as prescribed in paragraphs (2) and (3).

(2) The swimming pool or spa shall either have at least two circulation suction outlets per pump that shall be hydraulically balanced and symmetrically plumbed through one or more "T" fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets, or be designed to use alternatives to suction outlets, including, but not limited to, skimmers or perimeter overflow systems to conduct water to the recirculation pump.

(3) The circulation system shall have the capacity to provide a complete turnover of pool water, as specified in Section 3124B of Chapter 31B of the California Building Standards Code (Title 24 of the California Code of Regulations).

(b) Suction outlets shall be covered with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or successor standard designated by the federal Consumer Product Safety Commission, that cannot be removed except with the use of tools. Slots or openings in the grates or similar protective devices shall be of a shape, area and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.

(c) Any backup safety system that an owner of a new swimming pool or spa may choose to install in addition to the requirements set forth in subdivisions (a) and (b) shall meet the standards as published in the document, "Guidelines for Entrapment Hazards: Making Pools and Spas Safer," Publication Number 363, March 2005, United States Consumer Product Safety Commission.

[Amended by Stats. 2012, Ch. 679, Sec. 2. (AB 2114) Effective January 1, 2013.]

115928.5. *Whenever a building permit is issued for the remodel or modification of an existing swimming pool, toddler pool or spa, the permit shall require that the suction outlet or suction outlets of the existing swimming pool, toddler pool or spa be upgraded so as to be equipped with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or a successor standard designated by the federal Consumer Product Safety Commission.*

[Amended by Stats. 2012, Ch. 679, Sec. 3. (AB 2114) Effective January 1, 2013.]

115929. *(a) The Legislature encourages a private entity, in consultation with the Epidemiology and Prevention for Injury Control Branch of the department, to produce an informative brochure or booklet, for consumer use, explaining the child drowning hazards of, possible safety measures for, and appropriate drowning hazard prevention measures for, home swimming pools and spas, and to donate the document to the department.*

(b) The Legislature encourages the private entity to use existing documents from the United States Consumer Product Safety Commission on pool safety.

(c) If a private entity produces the document described in subdivisions (a) and (b) and donates it to the department, the department shall review and approve the brochure or booklet.

(d) Upon approval of the document by the department, the document shall become the property of the state and a part of the public domain. The department shall place the document on its Web site in a format that is readily available for downloading and for publication. The department shall review the document in a timely and prudent fashion and shall complete the review within 18 months of receipt of the document from a private entity.

(Added by Stats. 2003, Ch. 422, Sec. 3. Effective January 1, 2004.)

SECTION 3110—AUTOMATIC VEHICULAR GATES

3110.1 General. Automatic vehicular gates shall comply with the requirements of Sections 3110.2 and 3110.3 and other applicable sections of this code.

3110.2 Vehicular gates intended for automation. Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

3110.3 Vehicular gate openers. Vehicular gate openers, where provided, shall be listed in accordance with UL 325.

SECTION 3111—SOLAR ENERGY SYSTEMS

3111.1 General. Solar energy systems shall comply with the requirements of this section.

3111.1.1 Wind resistance. Rooftop-mounted photovoltaic (PV) panel systems and solar thermal collectors shall be designed in accordance with Section 1609.

Exception: [DSA-SS, DSA-SS/CC, HCD-1, HCD-2] *Rooftop-mounted photovoltaic (PV) panel systems and solar thermal collectors shall be designed in accordance with Section 1511.10 of this code.*

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3111.1.2 Roof live load. Roof structures that provide support for solar energy systems shall be designed in accordance with Section 1607.22.

3111.2 Solar thermal systems. Solar thermal systems shall be designed and installed in accordance with this section, the *California Plumbing Code*, the *California Mechanical Code* and the *California Fire Code*. Where light-transmitting plastic covers are used, solar thermal collectors shall be designed in accordance with Section 2606.12.

3111.2.1 Equipment. Solar thermal systems and components shall be listed and labeled in accordance with ICC 900/SRCC 300 and ICC 901/SRCC 100.

3111.3 Photovoltaic solar energy systems. Photovoltaic solar energy systems shall be designed and installed in accordance with this section, the *California Fire Code*, *the California Electrical Code and* the manufacturer's installation instructions.

3111.3.1 Equipment. Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

3111.3.2 Fire classification. Rooftop-mounted photovoltaic (PV) panel systems shall have a fire classification in accordance with Section 1505.9. Building-integrated photovoltaic (BIPV) systems installed as roof coverings shall have a fire classification in accordance with Section 1505.8.

3111.3.3 Building-integrated photovoltaic (BIPV) systems. BIPV systems installed as roof coverings shall be designed and installed in accordance with Section 1507.

[F] 3111.3.4 Access and pathways. Roof access, pathways and spacing requirements shall be provided in accordance with Section 1205 of the *California Fire Code*.

3111.3.5 Elevated photovoltaic (PV) support structures. Elevated PV support structures shall comply with either Section 3111.3.5.1 or 3111.3.5.2.

Exception: Elevated PV support structures that are installed over agricultural uses.

3111.3.5.1 Photovoltaic (PV) panels installed over open-grid framing or a noncombustible deck. Elevated PV support structures with PV panels installed over open-grid framing or over a noncombustible deck shall have PV panels tested, listed and labeled with a fire type rating in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Photovoltaic panels marked "not fire rated" shall not be installed on elevated PV support structures.

3111.3.5.2 Photovoltaic (PV) panels installed over a roof assembly. Elevated PV support structures with a PV panel system installed over a roof assembly shall have a fire classification in accordance with Section 1505.9.

3111.3.6 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic panel systems shall be designed and installed in accordance with Chapter 16 and the *California Fire Code*.

3111.3.6.1 Fire separation distances. Ground-mounted photovoltaic panel systems shall be subject to the fire separation distance requirements determined by the local jurisdiction.

SECTION 3112—GREENHOUSES

3112.1 General. The provisions of this section shall apply to greenhouses that are designed and used for the cultivation, maintenance, or protection of plants.

[BE] 3112.2 Accessibility. Greenhouses shall be accessible in accordance with Chapter 11. ***[HCD 1]*** *Greenhouses accessory to covered multifamily dwellings, as defined in Chapter 2, used as a common use facility, shall be on an accessible route in accordance with Chapter 11A.*

3112.3 Structural design. Greenhouses shall comply with the structural design requirements for greenhouses in Chapter 16.

Exception: [DSA-SS and DSA-SS/CC] *Greenhouses considered to be school buildings shall comply with the structural design requirements in Chapter 16A and in accordance with Part 1, California Administrative Code, Title 24, CCR.*

3112.4 Glass and glazing. Glass and glazing used in greenhouses shall comply with Section 2405.

3112.5 Light-transmitting plastics. Light-transmitting plastics shall be permitted in lieu of plain glass in greenhouses and shall comply with Section 2606.

3112.6 Membrane structures. Greenhouses that are membrane structures shall comply with Section 3102.

3112.6.1 Plastic film. Plastic films used in greenhouses shall comply with Section 3102.3.

SECTION 3113—RELOCATABLE BUILDINGS

3113.1 General. The provisions of this section shall apply to relocatable buildings. Relocatable buildings manufactured after the effective date of this code shall comply with the applicable provisions of this code. ***[DSA-SS and DSA-SS/CC]*** *as enforced by the enforcement agency.*

Exception: This section shall not apply to manufactured housing used as dwellings.

[HCD] *The provisions of Section 3113 are not applicable to commercial modulars, manufactured homes, mobilehomes, multi-unit manufactured housing and special purpose commercial modulars as defined in Health and Safety Code Sections 18001.8, 18007, 18008, 18008.7 and 18012.5, respectively. These structures are subject to installation/reinstallation requirements specified in the Mobilehome*

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Parks Act (Health and Safety Code Section 18200 et seq.) and the California Code of Regulations, Title 25, Division 1, Chapter 2. Manufactured homes must meet unit identification (data plate) and certification label requirements as specified in the Code of Federal Regulations, Title 24, Subtitle B, Chapter XX, Part 3280 and Health and Safety Code Section 18032. Commercial modulars and special purpose commercial modulars must meet identification requirements in the California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 2.

3113.1.1 Compliance. A newly constructed relocatable building shall comply with the requirements of this code for new construction. ***[DSA-SS and DSA-SS/CC]*** *as enforced by the enforcement agency.* An existing relocatable building that is undergoing alteration, addition, change of occupancy or relocation shall comply with Chapter 14 of the *California Existing Building Code*.

Exception: [DSA-SS and DSA-SS/CC] *An existing relocatable public school building that is undergoing alteration, addition or change of occupancy shall comply with Chapter 3 of the California Existing Building Code.*

3113.2 Supplemental information. Supplemental information specific to a relocatable building shall be submitted to the authority having jurisdiction. It shall, as a minimum, include the following in addition to the information required by Section 105:

Exception: [DSA-SS and DSA-SS/CC] *Supplemental information specific to a relocatable building shall be submitted to the enforcement agency. It shall, as a minimum, include the following in addition to the information required by Section 1603A:*

1. Manufacturer's name and address.
2. Date of manufacture.
3. Serial number of module.
4. Manufacturer's design drawings.
5. Type of construction in accordance with Section 602.
6. Design loads including: roof live load, roof snow load, floor live load, wind load and seismic site class, use group and design category.
7. Additional building planning and structural design data.
8. Site-built structure or appurtenance attached to the relocatable building.

3113.3 Manufacturer's data plate. Each relocatable module shall have a data plate that is permanently attached on or adjacent to the electrical panel, and shall include the following information:

1. Occupancy group.
2. Manufacturer's name and address.
3. Date of manufacture.
4. Serial number of module.
5. Design roof live load, design floor live load, snow load, wind and seismic design.
6. Approved quality assurance agency or approved inspection agency.
7. Codes and standards of construction.
8. Envelope thermal resistance values.
9. Electrical service size.
10. Fuel-burning equipment and size.
11. Special limitations if any.

Exception: [DSA-SS and DSA-SS/CC] *Each relocatable module shall have two metal identification labels permanently attached to the structure as enforced by the enforcement agency.*

3113.4 Inspection agencies. The building official is authorized to accept reports of inspections conducted by approved inspection agencies during off-site construction of the relocatable building, and to satisfy the applicable requirements of Sections 110.3 through 110.3.12.1.

Exception: [DSA-SS and DSA-SS/CC] *Each relocatable module shall be inspected during construction and installation at the project site by project inspectors acceptable to the enforcement agency in accordance with Part 1, California Administrative Code, Title 24, CCR.*

SECTION 3114—INTERMODAL SHIPPING CONTAINERS

[OSHPD 1, 1R, 2, 4 & 5] *Not permitted by OSHPD.*

3114.1 General. The provisions of Section 3114and other applicable sections of this code shall apply to intermodal shipping containers that are repurposed for use as buildings or structures, or as a part of buildings or structures.

Exceptions: ***[DSA-SS & DSA-SS/CC]*** *Not permitted by DSA.*

1. Intermodal shipping containers previously approved as existing relocatable buildings complying with Chapter 14 of the *California Existing Building Code.*
2. Stationary storage battery arrays located in intermodal shipping containers complying with Chapter 12 of the *California Fire Code.*
3. Intermodal shipping containers that are listed as equipment complying with the standard for equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.

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4. Intermodal shipping containers housing or supporting experimental equipment are exempt from the requirements of Section 3114, provided that they comply with all of the following:
    4.1. Such units shall be single stand-alone units supported at grade level and used only for occupancies as specified under Risk Category I in Table 1604.5.
    4.2. Such units are located a minimum of 8 feet (2438 mm) from adjacent structures, and are not connected to a fuel gas system or fuel gas utility.
    4.3. In hurricane-prone regions and flood hazard areas, such units are designed in accordance with the applicable provisions of Chapter 16.
5. ***[HCD]*** *Shipping containers constructed or converted off-site that meet the definition of Factory-built Housing in Health and Safety Code Section 19971 or Commercial Modular(s) as defined in Health and Safety Code Section 18001.8 shall be approved by the Department of Housing and Community Development.*

3114.2 Construction documents. The construction documents shall contain information to verify the dimensions and establish the physical properties of the steel components and wood floor components of the intermodal shipping container, in addition to the information required by Sections 107 and 1603.

3114.3 Intermodal shipping container information. Intermodal shipping containers shall bear an existing data plate containing the following information as required by ISO 6346 and verified by an approved agency. A report of the verification process and findings shall be provided to the building owner.

1. Manufacturer's name or identification number.
2. Date manufactured.
3. Safety approval number.
4. Identification number.
5. Maximum operating gross mass or weight (kg) (lbs).
6. Allowable stacking load for 1.8G (kg) (lbs).
7. Transverse racking test force (Newtons).
8. Valid maintenance examination date.

Where approved by the building official, the markings and existing data plate are permitted to be removed from the intermodal shipping containers before they are repurposed for use as buildings or structures or as a part of buildings or structures.

3114.4 Protection against decay and termites. Wood structural floors of intermodal shipping containers shall be protected from decay and termites in accordance with the applicable provisions of Section 2304.12.1.1.

3114.5 Under-floor ventilation. The space between the bottom of the floor joists and the earth under any intermodal shipping container, except spaces occupied by basements and cellars, shall be provided with ventilation in accordance with Section 1202.4.

3114.6 Roof assemblies. Intermodal shipping container roof assemblies shall comply with the applicable requirements of Chapter 15.

Exception: Single-unit, stand-alone intermodal shipping containers not attached to, or stacked vertically over, other intermodal shipping containers, buildings or structures. ***[DSA-SS & DSA-SS/CC]*** *Not permitted by DSA.*

3114.7 Joints and voids. Joints and voids that create concealed spaces between connected or stacked intermodal shipping containers at fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system in accordance with Section 715.

3114.8 Structural. Intermodal shipping containers that conform to ISO 1496-1 and are repurposed for use as buildings or structures, or as a part of buildings or structures, shall be designed in accordance with Chapter 16 and this section.

3114.8.1 Foundations and supports. Intermodal shipping containers repurposed for use as a permanent building or structure shall be supported on foundations or other supporting structures designed and constructed in accordance with Chapters 16 through 23.

3114.8.1.1 Anchorage. Intermodal shipping containers shall be anchored to foundations or other supporting structures as necessary to provide a continuous load path for all applicable design and environmental loads in accordance with Chapter 16.

3114.8.1.2 Stacking. Intermodal shipping containers used to support stacked units shall comply with Section 3114.8.4.

3114.8.2 Welds. The strength of new welds and connections shall be of not less than the strength provided by the original connections. All new welds and connections shall be designed and constructed in accordance with Chapters 16, 17 and 22.

3114.8.3 Structural design. The structural design for the intermodal shipping containers repurposed for use as a building or structure, or as part of a building or structure, shall comply with Section 3114.8.4 or 3114.8.5.

3114.8.4 Detailed design procedure. A structural analysis meeting the requirements of this section shall be provided to the building official to demonstrate the structural adequacy of the intermodal shipping containers.

Exception: Structures using an intermodal shipping container designed in accordance with Section 3114 8.5.

3114.8.4.1 Material properties. Structural material properties for existing intermodal shipping container steel components shall be established by Section 2201.2.

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3114.8.4.2 Seismic design parameters. The seismic force-resisting system shall be designed and detailed in accordance with ASCE 7 and one of the following:

1. Where all or portions of the profiled steel panel elements are considered to be the seismic force-resisting system, design and detailing shall be in accordance with the AISI S100 and ASCE 7, Table 12.2-1 requirements for steel systems not specifically detailed for seismic resistance, excluding cantilever column systems. ***[DSA-SS & DSA-SS/CC]*** *Not permitted by DSA.*
2. Where all or portions of the profiled steel panel elements are not considered to be part of the seismic force-resisting system, an independent seismic force-resisting system shall be selected and detailed in accordance with ASCE 7, Table 12.2-1.
3. Where all or portions of the profiled steel panel elements are retained and integrated into a seismic force-resisting system other than as permitted by Item 1, seismic design parameters shall be developed from testing and analysis in accordance with Section 104.2.3 and ASCE 7, Section 12.2.1.1 or 12.2.1.2.

3114.8.4.3 Allowable shear value. The allowable shear values for the profiled steel panel side walls and end walls shall be determined in accordance with the design approach selected in Section 3114.8.4.2. Where penetrations are made in the side walls or end walls designated as part of the lateral force-resisting system, the penetrations shall be substantiated by rational analysis.

3114.8.5 Simplified structural design procedure of single-unit containers. Single-unit intermodal shipping containers conforming to the limitations of Section 3114.8.5.1 shall be permitted to be designed in accordance with Sections 3114.8.5.2 and 3114.8.5.3. ***[DSA-SS & DSA-SS/CC]*** *Not permitted by DSA.*

3114.8.5.1 Limitations. The use of Section 3114.8.5 is subject to the following limitations:

1. The intermodal shipping container shall be a single-unit, stand-alone unit supported on a foundation and shall not be in contact with or supporting any other shipping container or other structure.
2. The intermodal shipping container top and bottom rails, corner castings, and columns or any portion thereof shall not be notched, cut, or removed in any manner.
3. The intermodal shipping container shall be erected in a level and horizontal position with the floor located at the bottom.
4. The intermodal shipping container shall be located in Seismic Design Category A, B, C or D.

3114.8.5.2 Structural design assumptions. Where permitted by Section 3114.8.5.1, single-unit, stand-alone intermodal shipping containers shall be designed using the following assumptions for the profile steel panel lateral-force resisting system:

1. The appropriate detailing requirements contained in Chapters 16 through 23.
2. Response modification coefficient, R = 2.
3. Overstrength factor, $\Omega_0 = 2.5$.
4. Deflection amplification factor, $C_d = 2$.
5. Limits on structural height, $h_n = 9.5$ feet (2900 mm).

3114.8.5.3 Allowable shear. The allowable shear for the profiled steel panel side walls (longitudinal) and end walls (transverse) for wind design and seismic design using the coefficients of Section 3114.8.5.2 shall be in accordance with Table 3114.8.5.3, provided that all of the following conditions are met:

1. The total linear length of all openings in any individual side wall or end wall shall be limited to not more than 50 percent of the length of that side wall or end wall, as shown in Figure 3114.8.5.3(1).
2. Any full-height wall length, or portion thereof, less than 4 feet (1219 mm) shall not be considered as a portion of the lateral force-resisting system, as shown in Figure 3114.8.5.3(2).
3. All side walls or end walls used as part of the lateral force-resisting system shall have an existing or new boundary element on all sides to form a continuous load path, or paths, with adequate strength and stiffness to transfer all forces from the point of application to the final point of resistance, as shown in Figure 3114.8.5.3(3).
4. Where openings are made in intermodal shipping container walls, floors or roofs, for doors, windows and other openings:
   4.1. The openings shall be framed with steel elements that are designed in accordance with Chapters 16 and 22.
   4.2. The cross section and material grade of any new steel element shall be equal to or greater than the steel element removed.
5. A maximum of one penetration not greater than 6 inches (152 mm) in diameter for conduits, pipes, tubes or vents, or not greater than 16 square inches (10 323 mm2) for electrical boxes, is permitted for each individual 8-foot (2438 mm) length of lateral force-resisting wall. Penetrations located in walls that are not part of the lateral force-resisting system shall not be limited in size or quantity. Existing intermodal shipping container vents shall not be considered a penetration, as shown in Figure 3114.8.5.3(4).

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6. End wall doors designated as part of the lateral force-resisting system shall be intermittently welded closed around the full perimeter of the door panels.

TABLE 3114.8.5.3—ALLOWABLE SHEAR VALUES FOR PROFILED STEEL PANEL SIDE WALLS AND END WALLS FOR WIND OR SEISMIC LOADING

CONTAINER DESIGNATION[b]	CONTAINER DIMENSION (nominal length)	CONTAINER DIMENSION (nominal height)	ALLOWABLE SHEAR VALUES (PLF)[a, c]	
			Side Wall	End Wall
1EEE	45 feet	9.5 feet	75	843
1EE		8.5 feet		
1AAA	40 feet	9.5 feet	84	
1AA		8.5 feet		
1A		8.0 feet		
1AX		< 8.0 feet		
1BBB	30 feet	9.5 feet	112	
1BB		8.5 feet		
1B		8.0 feet		
1BX		< 8.0 feet		
1CC	20 feet	8.5 feet	168	
1C		8.0 feet		
1CX		< 8.0 feet		
1D	10 feet	8.0 feet	337	
1DX		< 8.0 feet		

For SI: 1 foot = 304.8 mm.

a. The allowable strength shear values for the side walls and end walls of the intermodal shipping containers are derived from ISO 1496-1 and reduced by a factor of safety of 5.

b. Container designation type is derived from ISO 668.

c. Limitations of Sections 3114.8.5.1 and 3114.8.5.3 shall apply.

FIGURE 3114.8.5.3(1)—BRACING UNIT DISTRIBUTION—MAXIMUM LINEAR LENGTH

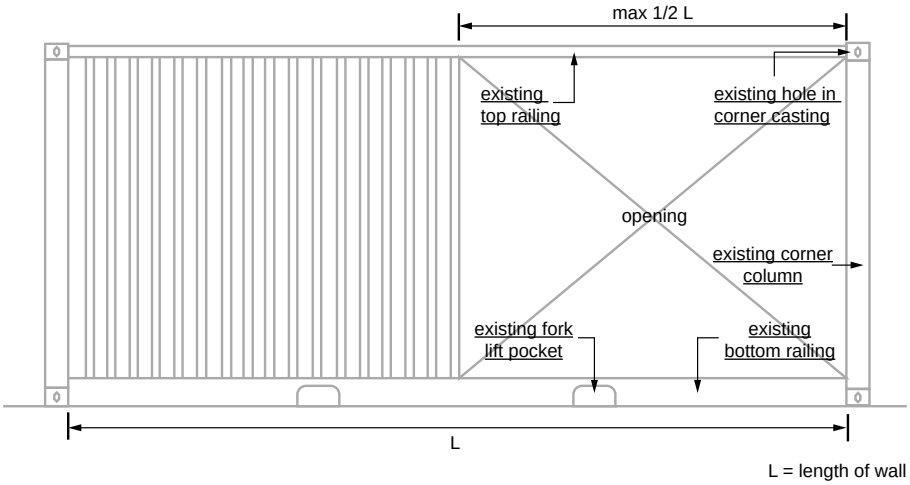

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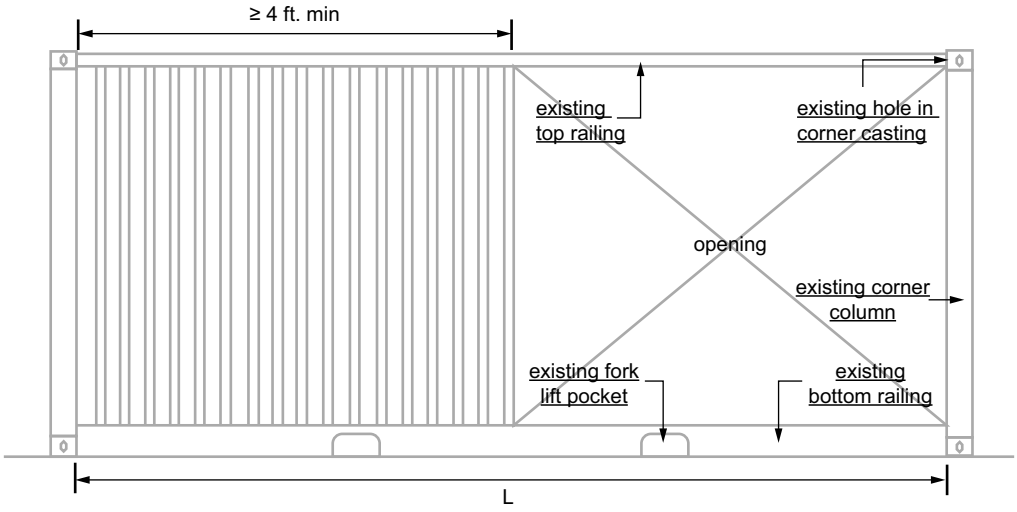
FIGURE 3114.8.5.3(2)—BRACING UNIT DISTRIBUTION—MINIMUM LINEAR LENGTH



L = length of wall

For SI: 1 foot = 304.8 mm.

FIGURE 3114.8.5.3(3)—BRACING UNIT DISTRIBUTION—BOUNDARY ELEMENTS

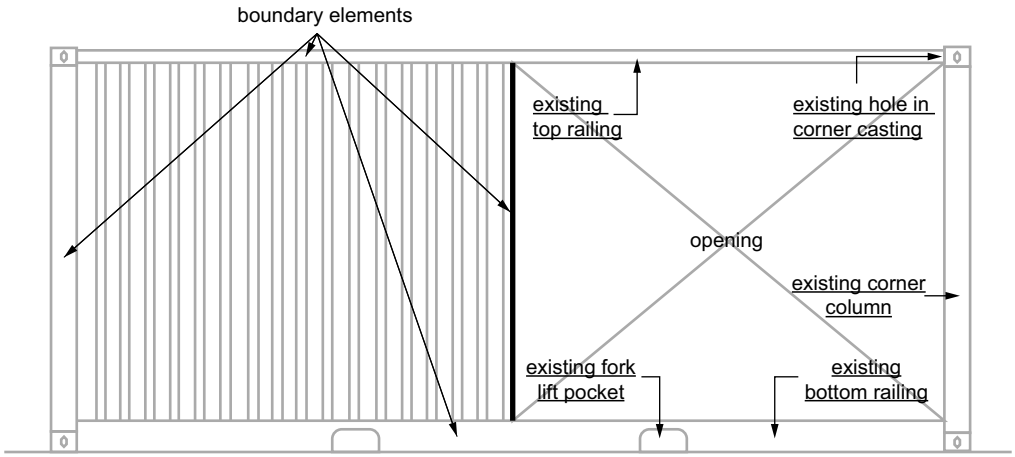
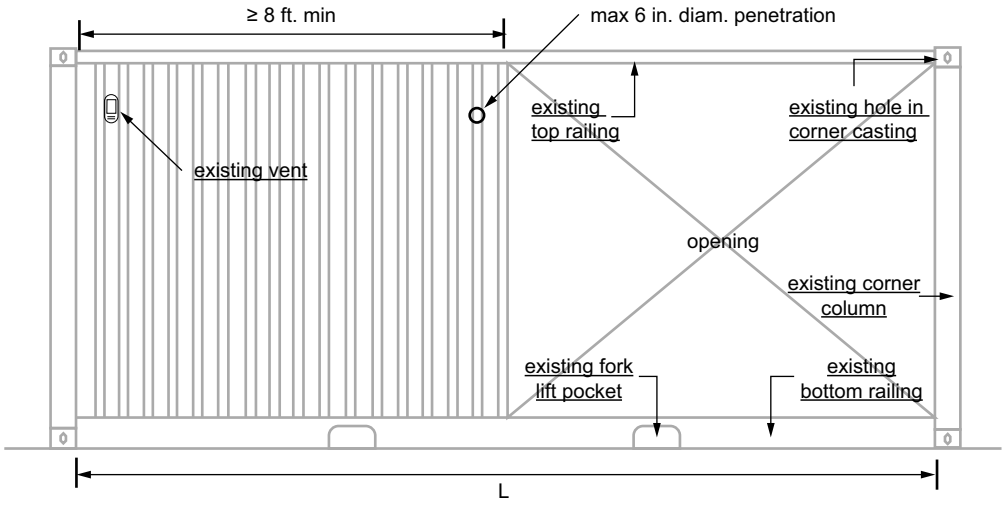


FIGURE 3114.8.5.3(4)—BRACING UNIT DISTRIBUTION—PENETRATION LIMITATIONS



L = length of wall

For SI: 1 foot = 304.8 mm.

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3114.9 Additional requirements. [DSA-SS and DSA-SS/CC]

3114.9.1 General.

1. *Intermodal shipping containers shall not have been manufactured earlier than 24 months from the date of DSA approval of the site-specific or stockpile building design drawings.*
2. *Intermodal shipping containers shall be undamaged and have no previous repairs. The acceptable tolerances shall not exceed those given in the ANSI/AISC 303—16: Code of Standard Practice for Steel Buildings and Bridges.*
3. *Intermodal shipping container type shall be standard dry cargo container, used for the transportation of dry goods only. Containers shall not have been used for transporting hazardous materials. Containers shall not have been painted with paint containing lead.*
4. *All structural elements and details shall be justified through engineering calculations in accordance with the California Administrative Code (Title 24, Part 1, CCR) Section 4-317(d).*

3114.9.2 Structural integrity verification. *Each intermodal shipping container shall have selection, structural integrity verification, general condition assessment, inspection and testing as enforced by the enforcement agency.*

3114.9.3 Seismic design requirements.

1. *The container steel frame contribution to the lateral force resistance shall be neglected even in cases where the container siding is removed.*
2. *Deformation compatibility of structural elements that are not included in the seismic force-resisting system shall be considered in the analysis and when evaluating stiffness irregularities.*
3. *The total length of siding (less openings) along a line in a lower story shall not be less than 80 percent of the total length of siding (less openings) along the same line in the story immediately above.*

CHAPTER

31A

SYSTEMS FOR WINDOW CLEANING OR EXTERIOR BUILDING MAINTENANCE

See Title 8, California Code of Regulations, Division 1, Chapter 4, Subchapter 7, General Industry Safety Orders, Group 1, Articles 5 and 6.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 31B – PUBLIC POOLS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																		**X**						
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below					**X**		**X**																	
Chapter / Section																								
3101B					X																			
3101B (last paragraph only)							X																	
3102B					X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

31B [DPH] PUBLIC POOLS

Division I—GENERAL

SECTION 3101B—SCOPE

The provisions of this chapter shall apply to the construction, installation, renovation, alteration, addition, relocation, replacement or use of any public pool and to its ancillary facilities, mechanical equipment and related piping. Public pools include those located in or designated as the following: commercial building, hotel, motel, resort, recreational vehicle or mobile home park, campground, apartment house, condominium, townhouse, homeowner association, club, community building or area, public or private school, health club or establishment, water park, swim school, medical facility, bed and breakfast, licensed day-care facility, recreation and park district and municipal pools.

***[HCD 2]** This chapter, as specified, shall apply to swimming pools in Mobilehome Parks as defined in Health and Safety Code Section 18214 and Special Occupancy Parks as defined in Health and Safety Code Section 18862.43.*

***Note:** Existing law limits application of building standards. Please see Health and Safety Code Sections 18938.5 and 116050.*

***[DSA-AC]** Refer to Chapter 11B for accessibility provisions applicable to public accommodations, commercial buildings and public housing.*

SECTION 3102B—DEFINITIONS

***ANCILLARY FACILITY** is any area used in conjunction with or for the operation of a pool such as public dressing rooms, lockers, shower or bathroom areas, drinking fountains, equipment room, pool deck area, pool enclosure or building space that is intended to be used by pool users.*

***BACKWASH** is the process of reversing the flow of water through the filter to thoroughly clean the filter media and/or elements and remove the debris from the contents of the filter vessel.*

***CANTILEVERED DECKING** is the part of the deck which extends over a top edge of a pool or spa.*

***CLEAN POOL WATER** is pool water that is free of dirt, oils, scum, algae, floating materials or visible organic and inorganic materials that would pollute the water.*

***CLEAR POOL WATER** is pool water that is free from cloudiness and is transparent.*

***COPING** is a slip-resistant cap installed on the top edge of a pool or spa.*

***CORROSION RESISTANT** is capable of maintaining original surface characteristics under the prolonged influence of the use environment.*

***DECK** is an area surrounding a pool which is specifically constructed or installed for use by pool users.*

***DIATOMACEOUS EARTH** is a filtering media consisting of microscopic fossilized skeletons of diatoms.*

***EASILY CLEANABLE** is a characteristic of a surface or material that allows removal of dirt, stains or residue by normal cleaning methods.*

***EFFECTIVE PARTICLE SIZE** is the theoretical size of a sieve in mm that will pass 10 percent by weight of sand.*

***ENFORCING AGENT** is the health officer, director of environmental health, registered environmental health specialist or environmental health specialist trainee.*

***[HCD 2] ENFORCING AGENT OR ENFORCING AGENCY** is the Department of Housing and Community Development, local building department or other local agency that has assumed responsibility for the enforcement of Health and Safety Code, Division 13, Part 2.1 commencing with Section 18200 for mobilehome parks and Health and Safety Code, Division 13, Part 2.3 commencing with Section 18860 for special occupancy parks.*

***EQUIPMENT AREA** is an area where the recirculation system and all related appurtenances are located.*

***HANDHOLD** is a structure located at or above the water line around the perimeter of the pool wall that allows a pool user to hold onto the poolside for support.*

***INLET** is a fitting or fixture through which recirculated water enters the pool.*

***LADDER** is a series of vertically separate treads or rungs either connected by vertical rail members or independently fastened to an adjacent vertical pool wall.*

***LIVING UNIT** is any building or portion thereof that contains living facilities including provisions for sleeping.*

***MAIN DRAIN** is a submerged suction outlet typically located at the bottom of a pool that conducts water to a recirculating pump.*

***MEDICAL POOL** is a special-purpose pool used by a State-recognized medical institution engaged in the healing arts under the direct supervision of licensed medical personnel for treatment of the infirm.*

***OUTLET** is a fitting or fixture through which recirculated water is removed from the pool which may or may not be connected to the pump.*

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PERFORMANCE STANDARD *is a standard that is accredited and published. Products compliant with a standard may be listed by any authorized nationally recognized testing laboratory.*

PERIMETER OVERFLOW SYSTEM *is a system which includes perimeter-type overflow gutters, surge basin or similar surface water collective system components and their interconnecting piping.*

PERMISSIBLE EXPOSURE LIMIT *is the maximum amount or concentration of a chemical that a worker may be exposed to under United States Occupational Safety and Health Administration regulations.*

POOL OR PUBLIC POOL *is an artificial basin, chamber or tank constructed or prefabricated with impermeable surfaces that is used, or intended to be used, for public swimming, diving or recreational activities but does not include individual therapeutic tubs or baths where the main purpose is the cleaning of the body. Any manmade lake or swimming lagoon with a sand beach or sand bottom is not a public pool.*

POOL OPERATOR or OPERATOR *is a person who is responsible for maintaining compliance with all requirements relating to pool operation, maintenance and safety of pool users.*

POOL USER *is a person using a pool and ancillary facilities for the purpose of water activities such as diving, swimming or wading.*

RADIUS OF CURVATURE *is the radius arc which denotes the curved surface from the point of departure from the springline of the pool to the pool bottom.*

READILY ACCESSIBLE *is capable of being reached easily for cleaning, repair, replacement or inspection without the necessity of removing a panel, door or similar obstruction and without requiring a person to climb over or remove obstacles or to use devices such as portable ladders.*

READILY DISASSEMBLED *means capable of being taken apart by hand or by using only simple tools such as a screwdriver, pliers or open-end wrench.*

RECESSED STEPS *are a series of vertically spaced cavities in the pool wall creating riser and tread areas for pool ingress and egress.*

RECIRCULATION SYSTEM *is the system of hydraulic components designed to remove, filter, disinfect and return water to the pool.*

RIM FLOW GUTTER *is a perimeter overflow system in which the overflow rim is at the same elevation with the deck.*

SKIMMER EQUALIZER LINE *is a submerged suction outlet located below the waterline and connected to the body of a skimmer that prevents air from being drawn into the pump if the water level drops below the skimmer weir or the skimmer is blocked by debris. A skimmer equalizer line is not a main drain.*

SLIP RESISTANT *is a rough finish that is not abrasive to the bare foot.*

SPA POOL OR SPA *is a pool that incorporates a water jet system, an aeration system or a combination of the two systems used in conjunction with heated water.*

SPECIAL PURPOSE POOL *is a pool constructed exclusively for a specific purpose, such as instruction, diving, competition or medical treatment.*

SPLASH ZONE *is the maximum distance the water from a spray ground can project horizontally.*

SPRAY GROUND *is a pool with no standing water in the splash zone and consists of a surge basin with a recirculation system from which water is directed through water features for contact with pool users.*

SPRINGLINE *is the point from which the pool wall breaks from vertical and begins its arc in the radius of curvature.*

STAIRS *are a series of two or more steps.*

STEP *is a riser and tread.*

SUCTION OUTLET *is any outlet that is connected to the pump through which water is removed from the pool.*

SURGE BASIN *is a reservoir or surge trench open to the atmosphere that receives water via gravity flow from the main drain, spray ground or perimeter overflow system and from which the recirculation system operates.*

TEMPERED WATER *is water between 100°F and 110°F.*

TURNOVER TIME *is the maximum time allowed to circulate one complete volume of the pool water through the recirculation system.*

UNIFORMITY COEFFICIENT *is the ratio of the theoretical size of a sieve in mm that will pass 60 percent of the sand to the theoretical size of a sieve in mm that will pass 10 percent of the sand.*

WADING POOL *is a pool intended to be used for wading by small children and having a maximum water depth of 18 inches (457 mm) at the deepest point.*

WATER FEATURE *means an interactive device or structure through which water is directed to the pool user such as a water fountain, water spray, dancing water jet, waterfall, dumping bucket or shooting water cannon.*

WATERLINE *shall be defined as one of the following:*

1. *Skimmer system. The waterline shall be the midpoint of the operating range of the skimmers.*
2. *Overflow system. The waterline shall be the top edge of the overflow rim.*

PLAN REVIEW, PERMITS, CONSTRUCTION AND FIELD INSPECTIONS

SECTION 3103B—PLAN REVIEW

3103B.1 *A person proposing to construct, renovate or alter a pool, ancillary facilities or equipment and appurtenances shall submit plans and specifications detailing compliance with this chapter to the enforcing agent for review and written approval prior to commencing construction and shall first be cleared by the enforcing agent before substitution if not an exact duplicate of the units being changed or replaced. A local building department shall not issue a permit for a public pool or ancillary facility until the plans have been approved by the enforcing agent.*

3103B.2 *Plans submitted for approval pursuant to this section shall be drawn to a scale of $^{1}/_{4}$ inch (6.4 mm) equals 1 foot (305 mm), except that plans for spa pools shall be drawn to a scale of 1 inch (25 mm) equals 1 foot (305 mm), unless otherwise approved by the enforcing agent.*

3103B.3 *The enforcing agent shall notify the person submitting the plans and specifications of approval or disapproval.*

3103B.4 *The enforcing agent shall retain one copy of the approved plans and specifications and any subsequent changes or modifications. The approved plans shall be valid for a period of two years from the date of approval or as extended by the enforcing agent.*

SECTION 3104B—CONSTRUCTION

Pools and all ancillary facilities, equipment and appurtenances shall be constructed, renovated or altered in compliance with plans approved pursuant to Section 3103B.

SECTION 3105B—PLAN COMPLIANCE INSPECTIONS

3105B *The pool owner, operator or designated agent shall notify the enforcing agent prior to scheduling the following inspections:*

1. *Exposed plumbing; and*
2. *Prior to applying pneumatically placed concrete; and*
3. *Prior to applying the final surface to the pool shell; and*
4. *At the completion of construction. No pool shall be opened to the public without the written approval of the enforcing agent.*

POOL STRUCTURE

SECTION 3106B—SPECIAL REQUIREMENTS FOR SPRAY GROUNDS

3106B Spray grounds. *All applicable provisions of this chapter shall apply to a spray ground unless specifically addressed in this section.*

3106B.1 *All parts of the spray ground shall be designed and constructed so that there are no safety hazards.*

3106B.2 Walking surface. *A minimum 4-foot wide walking surface shall extend around the perimeter of the splash zone of a spray ground.*

3106B.3 *The recirculation system shall be in operation at all times that the spray ground is open for use and shall have a minimum of four turnover cycles prior to opening for proper disinfection and filtration.*

3106B.4 *There shall be no standing water within the splash zone.*

3106B.5 *Nozzles that spray from the ground level shall be flush with the ground with openings no greater than $^{1}/_{2}$ inch. Spray ground water features that extend above the ground must be clearly visible.*

3106B.6 *The splash zone shall be sloped so that only water from the spray ground water feature flows back to the surge basin. Areas adjacent to the splash zone shall be sloped away from the spray ground to deck drains or other surface water disposal systems.*

3106B.7 *All foggers and misters that produce finely atomized mists shall be supplied directly from a potable water source and not from the surge basin.*

3106B.8 *When multiple pumps are used the control systems for the spray ground water feature pump and recirculation system pump shall be electrically interconnected so that when the recirculation pump is off the spray ground water feature pump also is off.*

3106B.9 *The spray ground shall have a surge basin or treatment tank constructed of materials which are inert, corrosion resistant, nontoxic and watertight including materials such as concrete, fiberglass, high density polyethylene, stainless steel or other materials as approved by the enforcing agent which can withstand all anticipated loadings under full and empty conditions as determined by an engineer or architect who has experience working on public pools.*

3106B.10 *The total volume of the surge basin shall be at least 4,000 gallons or a minimum of three times the gallons per minute flow rate of all the spray ground pumps and the recirculation pump combined, whichever is higher.*

3106B.11 *The turnover time shall be one-half hour or less.*

3106B.12 *The suction intake for the spray ground or water feature pump in the surge basin shall be located adjacent to the recirculation return line.*

3106B.13 *When separate pumps are used, the suction intake for the recirculation pump shall be located in the lowest portion of the surge basin and on the opposite side from the suction intake for the spray ground pump.*

3106B.14 *The surge basin shall be designed to have easy access for cleaning and inspection. The basin shall have at least one ladder access and shall have at least one 3-foot by 3-foot access opening. Lids shall be locked or require a tool to open.*

3106B.15 *The surge basin shall be equipped with an automatic make up water fill device through an air gap or be protected by an approved backflow prevention device in accordance with Chapter 6 of the California Plumbing Code.*

3106B.16 *Ultraviolet light disinfection shall be used to supplement disinfection methods required in this chapter unless another treatment process is provided that has been determined by a nationally recognized testing laboratory to be capable of providing at least the equivalent level of reduction of cryptosporidium as the ultraviolet light disinfection system specified in this section. The ultraviolet light disinfection unit shall comply with the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.*

3106B.17 *An accurately calibrated ultraviolet light intensity meter that has been properly filtered to restrict its sensitivity to the disinfection spectrum shall be installed in the wall of the disinfection chamber at the point of greatest water depth from the light source.*

3106B.18 *The ultraviolet light unit shall be located on the recirculation system and shall be installed to provide treated water directly to the spray features.*

3106B.19 *The ultraviolet light disinfection system must be equipped with an automatic shutdown system that inactivates the water feature pump if the ultraviolet dosage rate drops below 40 mJ/cm^2.*

3106B.20 *Artificial lighting shall be provided at all spray ground pads which are used at night or which do not have adequate natural lighting so that all portions of the spray pad and deck may be seen easily. Lighting that may be exposed to the feature pool water shall be installed in accordance with the manufacturer's specifications and the California Electrical Code.*

3106B.21 *A means of diverting runoff from the splash zone shall be installed on the spray ground drainage piping before the surge basin to divert water to the storm drainage system when the spray ground is not in operation.*

3106B.22 *A removable and cleanable catch screen or basket shall be installed on the spray ground drainage system before it enters the reservoir to prevent larger debris from collecting in the surge basin.*

SECTION 3107B—ALTERNATIVE EQUIPMENT, MATERIALS AND METHODS OF CONSTRUCTION

3107B.1 *The enforcing agent may approve an alternative equipment, material or method of construction provided it finds that the proposed design is satisfactory and complies with the provisions of this chapter, that the equipment, material, method or work offered is, for the purpose intended, at least equivalent to that prescribed in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation or that the methods of installation proposed conform to other acceptable nationally recognized standards.*

3107B.2 *The enforcing agent shall require that sufficient evidence or proof be submitted to substantiate claims that may be made regarding the use of alternative equipment, material or method of construction.*

3107B.3 *Whenever there is insufficient evidence of compliance with the provisions of this chapter, the enforcing agent may require tests as proof of compliance to be made at no expense to the enforcing agent. Tests shall be made in accordance with approved standards, but in the absence of such standards the enforcing agent may specify the test procedure.*

SECTION 3108B—POOL CONSTRUCTION

3108B.1 Pool shell. *The pool shall be built of reinforced concrete or material equivalent in strength, watertight and able to withstand anticipated stresses under both full and empty conditions taking into consideration factors such as climatic effects, geological conditions and integration of the pool with other structures.*

3108B.2 Finish. *The finished pool shell shall be lined with a smooth waterproof interior finish that will withstand repeated brushing, scrubbing and cleaning procedures. The interior pool finish shall completely line the pool to the tile lines, coping or cantilevered deck.*

3108B.3 Finish color. *The finish color shall be white except for the following which shall be of contrasting color:*

1. *Lane and other required pool markings described in Section 3110B; and*
2. *The top surface edges of benches in spa pools; and*
3. *The edge of pool steps; and*
4. *Tiles installed at the waterline; and*
5. *Tiles installed at the $4^1/_2$-foot (1372 mm) depth line.*

Exception: *A spa pool may be finished in a light color other than white when approved by the enforcing agent.*

3108B.4 Projections and recessed areas. *The pool shell shall not have projections or recessed areas except for pool inlets and outlets as specified in Section 3137B.*

Exception: *This section shall not apply to handholds, recessed steps, ladders, stairs, handrails, skimmers or perimeter overflow systems.*

SECTION 3109B—POOL GEOMETRY

3109B.1 General. *A pool shall conform to the appropriate criteria in Figures 31B-1 through 31B-7.*

Exception: *A special purpose pool may be exempted from construction standards that are not applicable to the proposed use.*

3109B.2 Dimensional tolerances. *A construction tolerance shall be permitted on all dimensions in Figures 31B-1 through 31B-3 not to exceed 2 inches (51 mm) except that the tolerance of the water level of a pool with a nonadjustable overflow system shall not exceed $^1/_8$ inch (3.2 mm).*

3109B.3 Bottom slope break. *Any portion of a pool having a water depth of $4^1/_2$ feet (1372 mm) or less shall have a uniform slope that shall not exceed 1 foot (305 mm) of vertical in 10 feet (3050 mm) of horizontal. In pools with water depths greater than $4^1/_2$ feet (1372 mm) the slope shall meet the requirements in Figures 31B-1 through 31B-3. There shall be a uniform water depth along the entire base of the stairs.*

SECTION 3110B—PERMANENT MARKINGS

3110B.1 General. *No markings, designs or lettering shall be permitted on the pool shell except for slip resistant lane markings, depth marking lines and safety markings.*

3110B.2 Lane markings. *Slip resistant lane lines at the bottom of the pool shall not exceed 12 inches (305 mm) in width.*

3110B.3 Depth marking line. *There shall be installed a straight line of slip resistant tile a minimum of 4 inches (102 mm) and not greater than 6 inches (152 mm) wide of a color contrasting with the background of the pool shell across the bottom of the pool where the water depth is $4^1/_2$ feet (1372 mm).*

Exception: *Pools having a maximum water depth of 5 feet (1524 mm) or less shall not be required to have a depth marking line.*

3110B.4 Water depth markers.

3110B.4.1 Location. *The water depth shall be clearly marked at the following locations:*

1. *Maximum depth; and*
2. *Minimum depth; and*
3. *Each end; and*
4. *Both sides at the shallowest and deepest part of the pool; and*
5. *At the break in the bottom slope between the shallow and deep portions of the pool (see also Section 3109B.3); and*
6. *Along the perimeter of the pool at distances not to exceed 25 feet (7620 mm).*

Exception: *A spa or wading pool shall have a minimum of two depth markers indicating the maximum depth.*

Note: *For an illustration diagram pertaining to this section see Figure 31B-8.*

3110B.4.2 Position. *Where required by Section 3110B.4.1, depth markers shall be located in the following positions:*

1. *On the coping or on the deck, the depth markers shall be placed as close as possible but no more than 3 feet (914 mm) from the pool water; and*
2. *For pools with skimmer systems the depth markers shall be high at the waterline which typically will result in the depth markers being submerged approximately 50 percent; or*
3. *For pools with perimeter overflow systems where coping cantilevers over the gutter depth markers may be positioned at the face of the cantilevered coping, the back wall above the gutter or immediately below the waterline which will result in the depth markers being completely submerged; or*
4. *For pools with rim flow gutters, depth markers shall be positioned immediately below the waterline which will result in the depth markers being completely submerged.*

3110B.4.3 Tolerance. *Depth markers shall be positioned to indicate the water depth accurate to the nearest 6 inches (152 mm) as measured at the waterline.*

3110B.4.4 Size of markers. *Depth markers shall:*

1. *Have numerals a minimum of 4 inches (102 mm) in height and of a color contrasting with the background and be marked in units of feet and inches. Abbreviations of FT and IN may be used in lieu of feet and inches; and*
2. *Be made of a durable material that is resistant to weathering; and*
3. *Be slip resistant when they are located on the pool deck.*

3110B.5 No diving markers. *For pool water depths 6 feet (1830 mm) or less no diving markers with the universal symbol of no diving, which is a red circle with a slash through it superimposed over the image of a diver, shall be installed on the deck directly adjacent to the depth markers required by Section 3110B.4.1. No diving markers shall comply with Section 3110B.4.4(2-3).*

SECTION 3111B—STEPS, RECESSED STEPS, LADDERS AND STAIRS

3111B.1 Construction. *A means of entry and exit to and from the pool shall consist of steps, recessed steps, ladders, stairs, ramps or a combination of these. Stairs or ramps shall be provided in the shallowest portion of a pool if the vertical distance from the bottom of the pool to the deck is over 1 foot (305 mm). In pools with more than one shallow end, stairs or ramps shall be provided at a minimum at one shallow end. A second means of entry and exit shall be provided in the deep portion of a pool having a depth greater than $4^1/_2$ feet (1372 mm). Where the width of the pool exceeds 30 feet (9144 mm), such means of entry and exit shall be provided at each side, not more than 100 feet (30,480 mm) apart.*

Note: *For illustrated diagrams pertaining to this section see Figures 31B-6 and 31B-7.*

3111B.2 Ladders. *Ladders shall be corrosion resistant and shall be equipped with slip resistant tread surfaces. Ladders shall be rigidly installed and shall provide a clearance of not less than 3 inches (76 mm) or more than 5 inches (127 mm) between any part of the ladder and the pool wall.*

3111B.3 Stairs. *Each step of a stair shall have a tread in accordance with Figure 31B-7. Risers shall conform to Figure 31B-7. At least one hand rail shall be provided extending from the deck to not less than a point above the top of the lowest step installed in accordance with Figure 31B-7.*

3111B.4 Ladder and recessed step dimensions. *Ladder treads and recessed steps shall have a minimum tread of 5 inches (127 mm) and a width of 14 inches (356 mm) and shall be designed to be readily cleaned. Step risers shall be uniform and shall not exceed 12 inches (305 mm) in height. The first riser shall be measured from the deck.*

3111B.5 Handrails for ladders and recessed steps. *Handrails shall be provided at the top of both sides of each ladder and recessed steps and shall extend over the coping or edge of the deck.*

3111B.6 Handrails for spas. *Two hand rails shall be provided extending from the deck to not less than a point above the top of the lowest step in accordance with Figure 31B-7. The steps shall be located where the deck is at least 4 feet (1219 mm) wide.*

3111B.7 Dimensional tolerances. *Finished step tread and riser construction tolerances shall be $+^{1}/_{2}$ inch (12.5 mm).*

[DSA-AC] *Additional requirements may apply. Refer to Chapter 11B for accessibility provisions applicable to public accommodations, commercial buildings and public housing.*

SECTION 3112B—HANDHOLDS

3112B.1 General. *Every pool shall be provided with handholds (perimeter overflow system, bull-nosed coping or cantilevered decking) around the entire perimeter installed not greater than 9 inches (229 mm) above the waterline.*

Exception: *Handholds are not required for wading pools.*

3112B.2 *For special purpose pools used for instruction or competitive swimming, a handhold at water level similar to the rim of a perimeter overflow system is required.*

3112B.3 *Where perimeter overflow systems are not provided, a bull-nosed coping or cantilevered decking of reinforced concrete, or material equivalent in strength and durability, with rounded slip resistant edges shall be provided. The overhang for either bull-nosed coping or cantilevered decking shall not exceed 2 inches (51 mm) or be less than 1 inch (25 mm) and shall not exceed $2^{1}/_{2}$ inches (64 mm) in thickness.*

Exception: *The enforcing agent may accept other handholds for spa pools.*

SECTION 3113B—DIVING BOARDS AND PLATFORMS

3113B.1 General. *Diving boards and platforms shall be anchored to the pool deck, constructed of corrosion resistant material, designed and constructed to be easily cleanable and finished with a durable slip resistant material.*

3113B.2 Rails and steps. *Diving boards or platforms greater than 18 inches (456 mm) in height above the deck shall be provided with a ladder or stairs for access. Hand rails shall be provided at all ladders and stairs leading to diving boards or platforms more than 1 meter above the water. Diving boards and platforms that are over 1 meter above the water shall have guard rails on both sides of the diving board or platform that extend to a point on the platform directly above the water's edge. Guard rails shall be 36 inches (914 mm) above the diving board or platform.*

3113B.3 Dimensions. *Dimensions and clearances for the use of diving boards or platforms shall conform to those shown in Figures 31B-1 and 31B-2. Platforms and diving boards shall conform to the USA Diving Rules and Codes, Part 1, Subpart A and Appendix B, effective January 1, 2010.*

SECTION 3114B—POOL DECKS

3114B.1 General. *A minimum continuous and unobstructed 4-foot wide (1219 mm) slip resistant, cleanable, nonabrasive deck area of concrete or like material shall be provided flush with the top of the pool coping extending completely around the pool, and the deck area shall further extend 4 feet (1219 mm) on both sides and rear of any diving board, fixed disabled access assistance device or slide and their appurtenances. The deck width shall be measured from the poolside edge of the coping lip.*

Exception: *A deck at least 4 feet (1219 mm) in width shall extend around a continuous 50 percent or more of the perimeter of a spa pool.*

3114B.2 Deck between pools and/or spas. *Where multiple pools and/or spas are built adjacent to each other, the deck width separating them shall be a minimum of 6 feet (1830 mm).*

3114B.3 Deck slope. *The pool's deck surface shall have a slope of no less than 1 percent ($^{1}/_{8}$ inch per foot) but no more than 2 percent ($^{1}/_{4}$ inch per foot) away from the pool to a deck drainage system and shall be constructed and finished to prevent standing water.*

3114B.4 Deck covering. *Deck coverings or other materials that are not equivalent to concrete in strength, durability and slip resistance and are not able to withstand repeated brushing, scrubbing or cleaning procedures shall not be installed or used within 4 feet (1219 mm) of the pool.*

3114B.5 Unpaved areas. *Landscape plants, flower beds or similar unpaved areas shall not be located within 4 feet (1219 mm) of a spa pool.*

SECTION 3115B—POOL LIGHTING

3115B.1 General. *Pools shall have underwater and deck lighting such that lifeguards or other persons may observe, without interference from direct and reflected glare from the lighting sources, every part of the underwater area and pool surface, all diving boards or other pool appurtenances. If underwater or deck surface lighting is not operational, the operator of the pool shall secure the pool area and not permit any use of the pool after dark and shall post the same sign as required in Section 3120B.9.*

Note: *See Part 3, Article 3-680, Title 24, California Code of Regulations for electrical installation requirements.*

3115B.2 Nighttime use. *Pools used at night shall be equipped with underwater lighting fixtures that will provide complete illumination to all underwater areas of the pool with no blind spots. Illumination shall enable a lifeguard or other persons to determine whether:*

1. *A pool user is lying on the bottom of the pool; and*
2. *The pool water conforms to the definition of "clear pool water."*

Exception: *Pools provided with a system of overhead lighting fixtures where it can be demonstrated to the enforcing agent that the system is equivalent to the underwater lighting fixture system.*

3115B.3 Deck area lighting. *When the pool is to be used at night, pool deck areas and emergency egress areas shall be provided with lighting so that persons walking on the deck can identify hazards. Lighting fixtures shall be aimed towards the deck area and away from the pool surface insofar as practical.*

ANCILLARY FACILITIES

SECTION 3116B—DRESSING, SHOWER AND TOILET FACILITIES

3116B.1 *Shower and dressing facilities shall be provided for users of a pool.*

Exceptions:

1. *Shower and dressing facilities may not be required when pool users have access to such facilities in adjacent living quarters.*
2. *Public toilet facilities may be omitted when pool users have access to toilet facilities either in living quarters located not more than 300 feet (91,440 mm) in travel distance from the pool or in an adjacent building such as a recreational facility, clubhouse or cabana.*

3116B.2 Number of sanitary facilities. *For the purpose of this subsection, one pool user shall be considered for every 15 square feet (1.39 m^2) of pool water surface area and/or spray ground splash zone area.*

3116B.2.1 Showers. *One shower shall be provided for every 50 pool users.*

3116B.2.2 Toilets. *Separate toilet facilities shall be provided for each sex. One toilet shall be provided for every 60 women or less and one toilet plus one urinal for every 75 men or less.*

3116B.2.3 Lavatories. *One lavatory shall be provided for every 80 pool users.*

3116B.3 Construction.

3116B.3.1 Floors. *Floors shall have a hard, nonabsorbent surface, such as portland cement concrete, ceramic tile or other approved material, which extends upwards onto the wall at least 5 inches (127 mm) with a coved base. Floors which may be walked on by a wet pool user shall be slip resistant. Floors shall be sloped not less than $^1/_4$ inch (6.4 mm) per foot to floor drains or other approved surface water disposal areas. Carpeting and other similar artificial floor covering shall not be permitted on shower and toilet room floors.*

3116B.3.2 Interior surfaces. *The materials used in the walls, except for structural elements, shall be of a type which is not adversely affected by moisture.*

3116B.3.3 Privacy. *All doors and windows shall be arranged to prevent viewing of the interior from any portion of the building used by the opposite sex and from view from the outdoors. View screens shall be permitted for this purpose.*

3116B.4 Water supply.

3116.B.4.1 *Showers and lavatories shall be provided with hot and cold water faucets.*

3116B.4.2 *Tempered water shall be permitted in lieu of individual hot and cold water faucets.*

3116B.4.3 *A means to limit the hot water to 110°F (43°C) maximum shall be provided to prevent scalding. This temperature limit control shall not be adjustable by the pool user.*

SECTION 3117B—DRINKING FOUNTAINS

One guarded jet drinking fountain shall be provided for the first 250 pool users and an additional fountain shall be provided for each additional 200 pool users or fraction thereof. The number of pool users shall be determined according to Section 3116B.2.

Exception: *Drinking fountains shall not be required when drinking water is available at adjacent living quarters, or in an adjacent building such as a bathhouse, cabana, clubhouse or recreational facility.*

SECTION 3118B—HOSE BIBBS

Potable water outlets with hose attachments shall be protected by a nonremovable hose bibb backflow preventer, a nonremovable hose bibb vacuum breaker or by an atmospheric vacuum breaker installed not less than 6 inches (152 mm) above the highest point of usage located on the discharge side of the last valve as required by the California Plumbing Code. In climates where freezing temperatures

occur, a listed self-draining frost-proof hose bibb with an integral backflow preventer or vacuum breaker shall be used. Hose bibbs shall be provided so that all portions of the pool deck area may be reached with a 75 foot length of hose attached to the hose bibb. A hose bibb shall be provided in the equipment area. Hose bibbs shall be located so that they do not constitute a hazard.

SECTION 3119B—POOL ENCLOSURE

3119B.1 Enclosure. *The pool shall be enclosed by one or a combination of the following: a fence, portion of a building, wall or other approved durable enclosure. Doors, openable windows, gates of living units or associated private premises shall not be permitted as part of the pool enclosure. The enclosure, doors and gates shall meet all of the following specifications:*

1. *The enclosure shall have a minimum effective perpendicular height of 5 feet (1524 mm) as measured from the outside as depicted in Figure 31B-4; and*
2. *Openings, holes or gaps in the enclosure, doors and/or gates shall not allow the passage of a 4-inch (102 mm) diameter sphere. The enclosure shall be constructed over a hard and permanent material equivalent to concrete; and*
3. *The enclosure shall be designed and constructed so that it cannot be readily climbed by small children. Horizontal and diagonal member designs which might serve as a ladder for small children are prohibited. Horizontal members shall be spaced at least 48 inches (1219 mm) apart. No planters or other structures that can be climbed shall be permitted within 5 feet (1524 mm) of the outside of the pool enclosure or within a 5 foot (1524 mm) arc as depicted in Figure 31B-5. The area 5 feet (1524 mm) outside of the pool enclosure shall be a common area open to the public; and*
4. *Chain link may be used, provided that the openings are not greater than $1^3/_4$ inches (44 mm) measured horizontally.*

3119B.2 Gates. *Gates and doors opening into the pool enclosure also shall meet the following specifications:*

1. *Gates and doors shall be equipped with self-closing and self-latching devices. The self-latching device shall keep the gate or door securely closed. Gates and doors shall open outwardly away from the pool except where otherwise prohibited by law. Hand activated door or gate opening hardware shall be located at a height no lower than 42 inches (1067 mm) but no higher than 44 inches (1179 mm) above the deck or walkway; and*
2. *Gates and doors shall be capable of being locked during times when the pool is closed. Exit doors which comply with Chapter 10, Title 24, California Code of Regulations shall be considered as meeting these requirements; and*
3. *The pool enclosure shall have at least one means of egress without a key for emergency purposes. Unless all gates or doors are so equipped, those gates and/or doors which will allow egress without a key shall have a sign in letters at least 4 inches (102 mm) high stating EMERGENCY EXIT; and*
4. *The enclosure shall be constructed so that all persons will be required to pass through common pool enclosure gates or doors in order to gain access to the pool area. All gates and doors exiting the pool area shall open into a public area or a walkway accessible by all patrons of the pool.*

3119B.3 Retroactivity. *Sections 3119B.1 and 3119B.2 shall apply only to public pool enclosures constructed on or after July 1, 1994. Notwithstanding the foregoing effective date, no fence enclosure shall be less than 4 feet (1219 mm) in height.*

3119B.4 Enclosure of pools constructed prior to July 1, 1994. *The enforcing agent may allow the installation of an enclosure which reduces the pool deck to less than 4 feet (1219 mm) in width when the physical characteristics of a site preclude providing a 4-foot (1219 mm) wide deck around the perimeter of an existing pool.*

SECTION 3120B—REQUIRED SIGNS

3120B.1 General. *All signs shall have clearly legible letters or numbers not less than 4 inches (102 mm) high, unless otherwise required in this section, affixed to a wall, pole, gate or similar permanent structure in a location visible to all pool users.*

3120B.2 Pool user capacity sign. *A sign shall indicate the maximum number of pool users permitted for each pool.*

3120B.2.1 Spa pool. *The pool user capacity of a spa pool shall be based on one pool user for every 10 square feet (0.929 m^2) of pool water surface area.*

3120B.2.2 Other pools. *The pool user capacity for all other pools shall be based on one pool user for every 20 square feet (1.858 m^2) of pool water surface area.*

Exception: *Pool user capacity requirements do not apply to wading pools or spray grounds.*

3120B.3 No diving sign. *Signs shall be posted in conspicuous places and shall state, "NO DIVING" at pools with a maximum water depth of 6 feet or less.*

3120B.4 No lifeguard sign. *Where no lifeguard service is provided, a sign shall be posted stating, "NO LIFEGUARD ON DUTY." The sign also shall state in letters at least 1 inch (25 mm) high, "Children should not use pool without adult supervision."*

Exception: *"No lifeguard sign" requirement does not apply to spray grounds that have no standing water.*

3120B.5 Artificial respiration and cardiopulmonary resuscitation sign. *An illustrated diagram with text at least $^1/_4$ inch (6 mm) high of artificial respiration and cardiopulmonary resuscitation procedures shall be posted.*

3120B.6 Emergency sign. *The emergency telephone number 911 with numbers not less than 4 inches (102 mm), the number of the nearest emergency services and the name and street address of the pool facility with numbers and text not less than 1 inch (25 mm) shall be posted.*

3120B.7 Warning sign for a spa pool. *A warning sign for spa pools shall be posted stating, "CAUTION" and shall include the following language in letters at least 1 inch (25 mm) high:*

1. *Elderly persons, pregnant women, infants and those with health conditions requiring medical care should consult with a physician before entering the spa.*
2. *Children should not use spa without adult supervision.*
3. *Hot water immersion while under the influence of alcohol, narcotics, drugs or medicines may lead to serious consequences and is not recommended.*
4. *Do not use alone.*
5. *Long exposure may result in hyperthermia, nausea, dizziness or fainting.*

3120B.8 Emergency shut off. *In letters at least one inch (25 mm) high a sign shall be posted at the spa emergency shut off switch stating, "EMERGENCY SHUT OFF SWITCH."*

3120B.9 No use after dark. *Where pools were constructed for which lighting was not required, a sign shall be posted at each pool entrance on the outside of the gate(s) stating, "NO USE OF POOL ALLOWED AFTER DARK."*

3120B.10 Keep closed. *A sign shall be posted on the exterior side of gates and doors leading into the pool enclosure area stating, "KEEP GATE CLOSED." or "KEEP DOOR CLOSED."*

[DSA-AC] *Additional requirements may apply. Refer to Chapter 11B for accessibility provisions applicable to public accommodations, commercial buildings and public housing.*

3120B.11 Diarrhea. *The pool operator shall post at the entrance area of a public pool a sign in letters at least 1 inch (25 mm) high that clearly states that persons with diarrhea and persons who have had diarrhea within the prior 14 days shall not enter the pool water.*

3120B.12 Wave pools. *A sign in letters at least 1 inch (25 mm) high shall be posted that describes the requirements for wave pools as described in Section 115952, Health and Safety Code.*

3120B.13 Spray ground sign. *A sign shall be posted at each spray ground and be visible from any part of the spray ground that states, "CAUTION: WATER IS RECIRCULATED. DO NOT DRINK."*

3120B.14 Exit. *Where automatic gaseous chlorine chemical feeders are used, a sign shall be posted at the pool area entrance which shows in a diagrammatic form an emergency evacuation procedure. Designated emergency exits shall be marked "EXIT."*

3120B.15 Gaseous oxidizer. *Where automatic gaseous chlorine chemical feeders are used, a warning sign with the appropriate hazard identification symbol shall be posted on the exterior side of the door entering the chemical feeder room or area. The sign shall state, "DANGER: GASEOUS OXIDIZER - (specific chemical name)" or as otherwise required by the California Fire Code.*

3120B.16 Turn on before entering. *Where automatic gaseous chemical feeders are used, a sign shall be posted at the switch to the light and ventilation system for the gaseous chemical feeder room stating, "TURN ON BEFORE ENTERING," or as otherwise required by the California Fire Code or the California Electrical Code.*

3120B.17 Direction of flow.

3120B.17.1. *The direction of flow for the recirculation equipment shall be labeled clearly with directional symbols such as arrows on all piping in the equipment area.*

3120B.17.2. *Where the recirculation equipment for more than one pool is located on site, the equipment shall be marked as to which pool the system serves.*

3120B.17.3. *Valves and plumbing lines shall be labeled clearly with the source or destination descriptions.*

SECTION 3121B—INDOOR POOL VENTILATION

Indoor pools, dressing rooms and toilet rooms shall be ventilated according to the requirements in Chapter 4 of the California Mechanical Code.

SECTION 3122B—POOL EQUIPMENT ENCLOSURE

For pools constructed on or after January 1, 2013, pool equipment shall be enclosed as follows:

1. *All equipment installed for recirculation, filtration and disinfection of pool water shall be installed so that access is limited to persons authorized by the pool owner or operator; and*
2. *Pool equipment shall be mounted on a continuous slab of concrete or other equivalent easily cleanable and nonabsorbent material; and*
3. *Floors shall be sloped a minimum of $^1/_4$ inch (6.4 mm) per foot to a drain.*

SECTION 3123B—GENERAL REQUIREMENTS

3123B.1 System description. *Each pool shall be provided with a separate recirculation system designed for the continuous recirculation, filtration and disinfection of the pool water. The system shall consist of pumps, filters, chemical feeders, skimmers or perimeter overflow systems, valves, pipes, connections, fittings and appurtenances.*

Exception: *Pools using fresh water equivalent in flow to the requirements of Section 3124B.*

Note: *Fresh makeup pool water shall conform to the water quality standards of Section 65531, Chapter 20, Title 22, California Code of Regulations.*

3123B.2 Equipment. *All pumps, filters, chemical feeders, skimmers and supplemental equipment shall comply with the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.*

3123B.3 Installation. *All equipment related to pool operations shall be installed and maintained according to this chapter and in accordance with the equipment manufacturer's written instructions.*

3123B.4 Equipment access. *All filters, valves, pumps, strainers and equipment shall be readily accessible for repair and replacement.*

SECTION 3124B—TURNOVER TIME

The recirculation system shall have the capacity to provide a complete turnover of pool water in:

1. *One-half hour or less for a spa pool; and*
2. *One-half hour or less for a spray ground; and*
3. *One hour or less for a wading pool; and*
4. *Two hours or less for a medical pool; and*
5. *Six hours or less for all other types of public pools.*

SECTION 3125B—RECIRCULATION PIPING SYSTEM AND COMPONENTS

3125B.1 Line sizes. *Pipes shall be sized so flow velocity of piping systems including all pipes and fittings other than inlet devices or venturi throats shall not exceed 6 feet per second (1.829 m/s) in any suction or copper piping and 8 feet per second (2.438 m/s) in any portion of the return system.*

3125B.1.1 Materials. *All piping, tubing and fittings shall comply with the applicable standards for potable water system materials set forth in Chapter 6 of the California Plumbing Code.*

3125B.2 Gauges. *A pressure and vacuum gauge shall be provided for each pump system. Each gauge shall have a scale range approximately $1^{1}/_{4}$ times the maximum anticipated working pressure or vacuum and shall be accurate within 2 percent of scale. The pressure gauge located on the filter shall be marked with the clean start up pressure reading.*

3125B.3 Flow meter. *A flow meter shall be provided on each recirculation system accurate to within 10 percent of flow and installed according to the manufacturer's written instructions with increments in the range of normal flow.*

3125B.4 Basket strainer. *A basket strainer shall be provided on the suction side of the recirculation pump. A basket strainer will not be required on pumps connected to vacuum filters where the filter elements are not removed for cleaning.*

3125B.5 Backwash piping. *Piping, including necessary valves conforming to Section 3125B.1, shall be provided for each filter vessel or element which requires periodic backwashing.*

3125B.6 Valves. *Valves shall not be located in any deck area surrounding a pool. Valves shall be installed on all recirculation, backwashing and drain system lines which require shutoff isolation, adjustment or control of the rate of flow. Each valve shall be installed in the equipment area and labeled as to its purpose.*

SECTION 3126B—RECIRCULATION PUMP CAPACITY

3126B.1 *Pool recirculation pumps shall have the following total dynamic head capacities:*

1. ***Pressure diatomaceous earth filters.*** *At least 60 feet (18,288 mm); and*
2. ***Vacuum diatomaceous earth filters.*** *Twenty inches (508 mm) vacuum on the suction side and 40 feet (12,192 mm) total dynamic head; and*
3. ***Rapid sand filters.*** *At least 45 feet (13,716 mm); and*
4. ***High rate sand filters.*** *At least 60 feet (18,288 mm); and*
5. ***Cartridge filters.*** *At least 60 feet (18,288 mm).*

3126B.2. *Pumps with other total dynamic head capacities shall be permitted provided the turnover times are maintained as required in Section 3124B.*

SECTION 3127B—WATER SUPPLY INLETS

3127B.1 General. *Each pool shall be supplied with potable water by means of a permanently installed pipeline from a public water supply system holding a permit from the California Department of Public Health or from a source approved by the enforcing agent.*

3127B.2 Backflow prevention. *There shall be no direct connection between any potable water supply system and the pool or its piping system unless protected by a backflow prevention device in accordance with Chapter 6 of the California Plumbing Code.*

3127B.3 Makeup water. *Automatic makeup water flow controls with a manual override control shall be provided to maintain the proper pool water level.*

SECTION 3128B—FILTERS (ALL TYPES)

3128B.1 General requirements. *All filters, regardless of type, shall be designed and constructed according to the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.*

3128B.2 Installation. *Each filter vessel shall be installed, piped and provided with valves so that it can be isolated from the recirculation system for repairs and backwashing.*

SECTION 3129B—RAPID SAND PRESSURE FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to rapid sand pressure filters.

3129B.1 Flow rates. *The filtration rate shall not exceed 3 gallons per minute per square foot (122.24 L/m per m^2) of filter area. The backwash rate shall not be less than 15 gallons per minute per square foot (611.2 L/m per m^2) of filter area.*

3129B.2 Filter media. *The filter shall contain not less than a 20-inch (508 mm) depth of media and not less than a 10-inch (254 mm) depth of filter gravel above the underdrain system.*

3129B.2.1 *The filter media shall have an effective particle size between 0.40 and 0.55 millimeters and a uniformity coefficient not exceeding 1.75.*

3129B.2.2 *The filter gravel shall be sized and placed to provide uniform flow distribution from the underdrain system and to support the bed of filter sand without loss of sand to the pool or without development of jet streams or channeling in the filtration media.*

SECTION 3130B—DIATOMACEOUS EARTH FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following applies to diatomaceous earth filters.

3130B.1 Flow rates. *The filtration rate for both pressure and vacuum diatomaceous earth filters shall not exceed 2 gallons per minute per square foot (81.49 L/m per m^2) of filter area.*

SECTION 3131B—HIGH-RATE SAND FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to high rate sand filters.

3131B.1 Flow rates. *Maximum and minimum flow rates for backwash and filtration shall be maintained according to the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.*

3131B.2 *The filter media shall have an effective particle size between 0.40 and 0.55 mm and a uniformity coefficient not exceeding 1.75.*

3131B.3 *The backwash rate for a high rate sand filter shall be a minimum of 15 gallons per minute per square foot of filter area.*

SECTION 3132B—CARTRIDGE FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to cartridge filters.

3132B.1 *The filtration rate shall not exceed 0.375 gallons per minute per square foot of filter area.*

3132B.2 *An approved wash down area equipped with potable water shall be provided in the pool equipment area with permanently installed drainage piping discharging to the public sewer or wastewater system approved by the enforcing wastewater agency. The filter vessel shall be capable of being drained and shall be equipped with an indirect drain for the purpose of draining the entire contents of the filter vessel. Drainage and backwash piping shall be considered indirect waste and installed in accordance with the requirements of Chapter 8 of the California Plumbing Code.*

3132B.3 *An additional set of filter elements shall be available for installation while the existing filter elements are cleaned.*

SECTION 3133B—CHEMICAL FEEDERS

All chemical feeders including disinfectant feeders and the auxiliary feeders used for solutions, slurries or solids, along with components such as pumps, strainers, tubing connections, tanks and injection fittings shall comply with the provisions of this section.

3133B.1 General design requirements. *The chemical feeder equipment shall:*

1. *Be maintained and repaired according to manufacturers' specifications; and*
2. *Be constructed with an adjustable output rate device to permit repeated adjustments without loss of output rate accuracy and adjusted by an automatic chemical monitoring and control system that regulates, at a minimum, pH and disinfectant; and*
3. *Meet the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.*

3133B.2 Piping. *Piping used for the chemical feeder and its auxiliary equipment shall be resistant to corrosion or chemical deterioration.*

3133B.3 Installation. *Chemical feeders and associated components shall be constructed and installed to prevent uncontrolled discharge or siphoning of chemicals and fumes directly into the pool, its recirculation system, the pool area or ancillary facilities.*

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SECTION 3134B—DISINFECTANT FEEDERS

Disinfectant feeders shall comply with applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010 for disinfectant feeders. In addition to the requirements for chemical feeders as indicated in Section 3133B, the following apply to disinfectant feeders.

3134B.1 Minimum capacity. *All feeders shall be capable of supplying not less than the equivalent of 3 pounds (1 kg) of 100 percent available chlorine per day per 10,000 gallons (37,850 L) of pool water capacity.*

3134B.2 Rate of flow adjustment. *A visible means of determining the rate of flow through the device shall be provided for each disinfectant feeder.*

3134B.3 Compressed chlorine gas disinfectant equipment. *Chlorine gas shall not be dispensed directly into the water of a pool except as an aqueous solution through the return line of the recirculation system.*

3134B.3.1 Compressed gas containers. *Each container or cylinder shall be secured to prevent accidental movement. A valve protection cap shall be provided to cover the discharge valve at all times when the cylinder is not connected to the dispensing system.*

3134B.3.2 Container scale. *Compressed gas chlorine containers in use shall be on a scale in the gas chlorinator room.*

3134B.3.3 Chlorine feeding device. *The chlorine feeding device shall be capable of delivering chlorine in an aqueous solution at the maximum design rate. The device shall not allow the backflow of pool water into the chlorine container. The device shall not allow the release of chlorine gas to the atmosphere under normal operating conditions. The device shall be designed and installed to conduct chlorine gas leaks to the outdoors during a release of chlorine gas or an interruption of the water supply.*

3134B.3.4 Piping. *Piping carrying chlorine gas under pressure shall not be located outside the gas chlorination equipment room.*

FIGURE 31B-1-DEPTHS AND CLEARANCES FOR POOLS WITH DIVING BOARDS GREATER THAN 30 INCHES (762 mm) ABOVE THE WATER

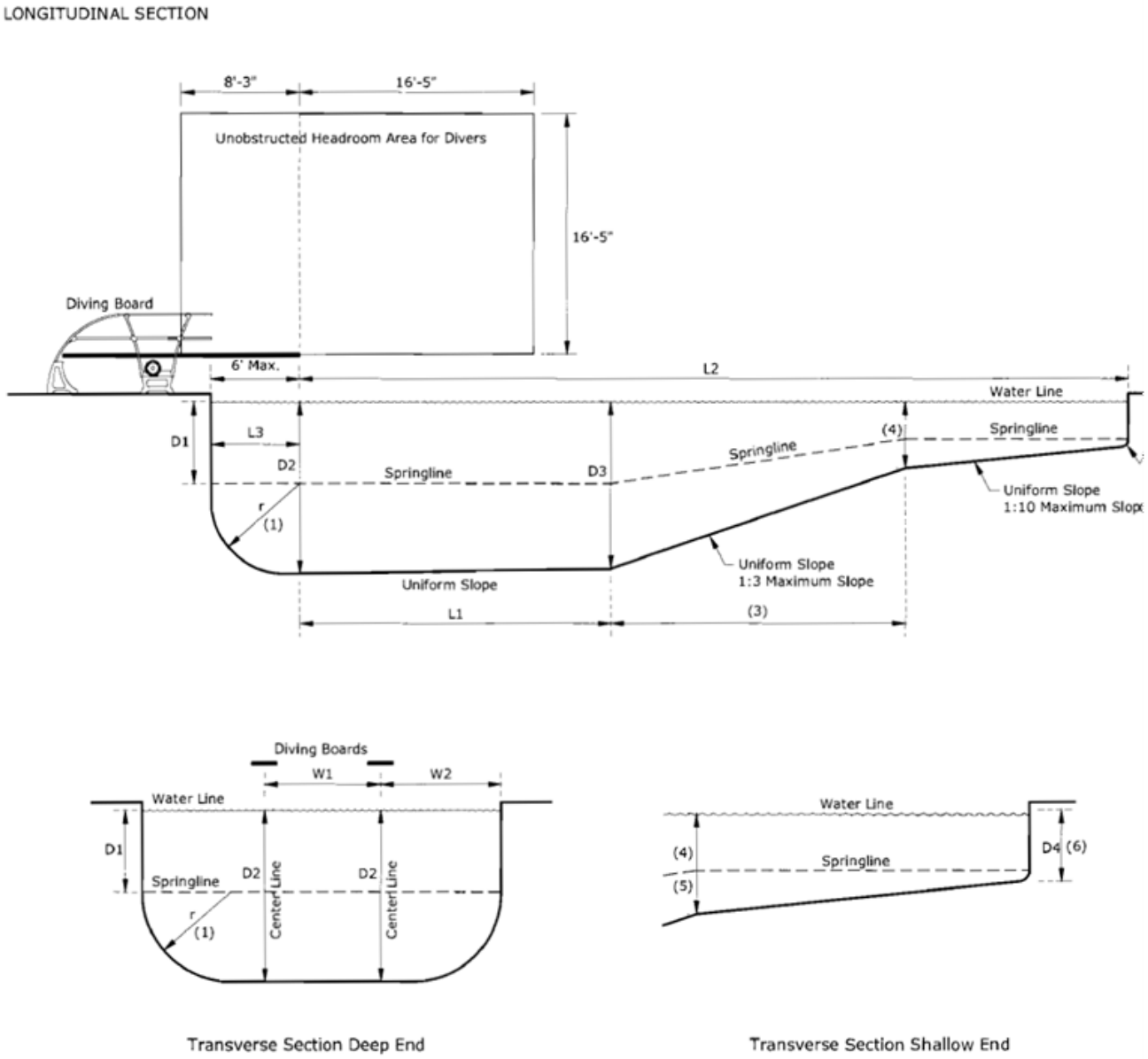

TABLE 31B-1										
	DEPTH OF WATER					LENGTH OF SECTION				
BOARDS AND PLATFORMS	DIM	D1	D2	D3	D4	L1	L2	L3	W1	W2
1-meter board	Min.	5'-6"	11'-6"	11'-2"	0'-0"	16'-5"	29'-7"	5'-11"	7'-11"	8'-3"
3-meter board	Min.	6'-6"	12'-6"	12'-2"	0'-0"	19'-9"	33'-8"	5'-11"	8'-7"	11'-6"

Notes for Figure 31B-1 and Table 31B-1:

1. *Maximum radius shall equal D2 minus D1 dimensions.*
2. *Radius at the shallow end shall not be more than 12 inches.*
3. *The length of a section is based on the maximum slope and other maximum and minimum dimensions.*
4. *Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".*
5. *The springline depth at (4) shall not be more than 4'-0".*
6. *The maximum water depth shall be 3'-6".*
7. *Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.*

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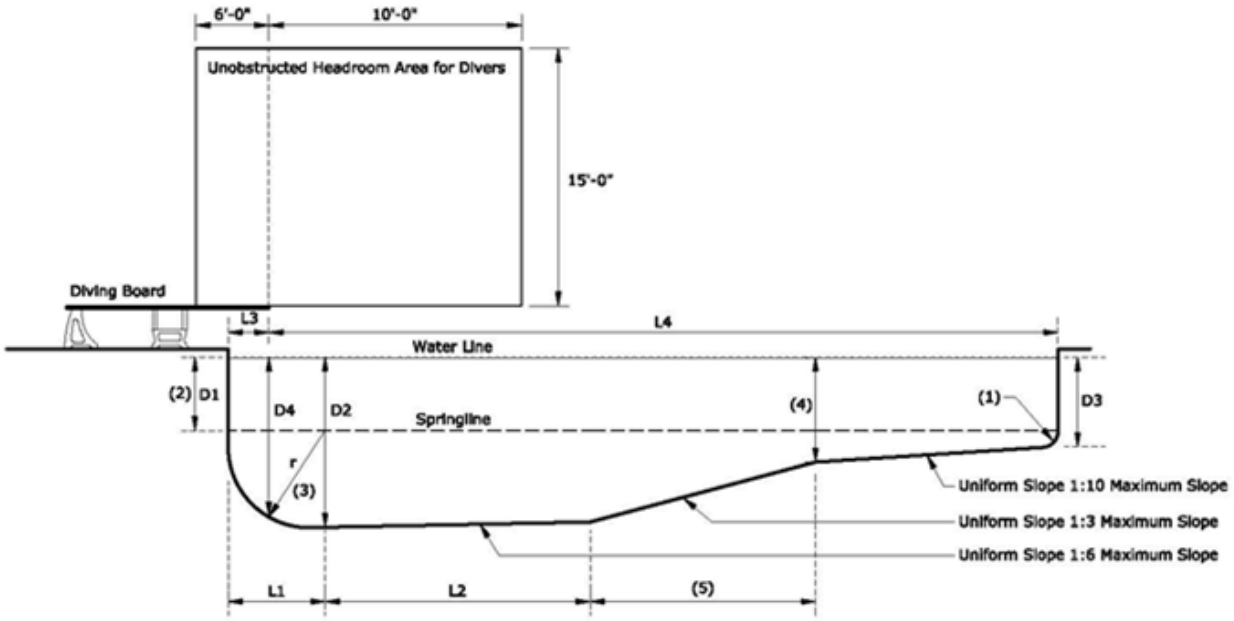
FIGURE 31B-2-DEPTHS AND CLEARANCES FOR POOLS WITH DIVING BOARDS 30 INCHES (762 MM) OR LESS ABOVE THE WATER LINE

LONGITUDINAL SECTION



TRANSVERSE SECTION AT D2

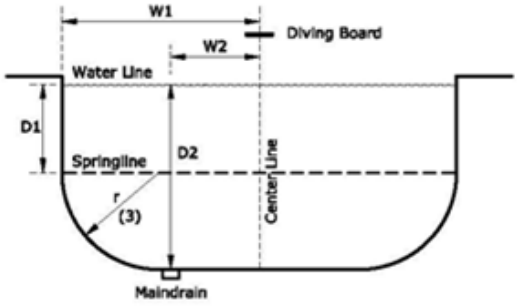


TABLE 31B-2										
	DEPTH OF WATER				LENGTH OF SECTION					
DIMENSION	D1	D2	D3	D4	L1	L2	L3		W1	W2
Minimum	2'-6"	8'-6"	0'-0"	7'-0"	6'-0"	6'-0"	2'-6"	30'-0"	9'-0"	3'-0"
Maximum	—	—	3'-6"	—	10'-0"	—	4'-0"	—	—	—

Notes for Figure 31B-2 and Table 31B-2:

1. *Radius at the shallow end shall be a maximum of 1'-0".*
2. *Springline D1 shall extend to the break in slope between the shallow area and the deep area.*
3. *Maximum radius shall equal D2 minus D1 dimensions.*
4. *Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".*
5. *Length of section is based on maximum slope and other maximum or minimum dimensions.*
6. *Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.*

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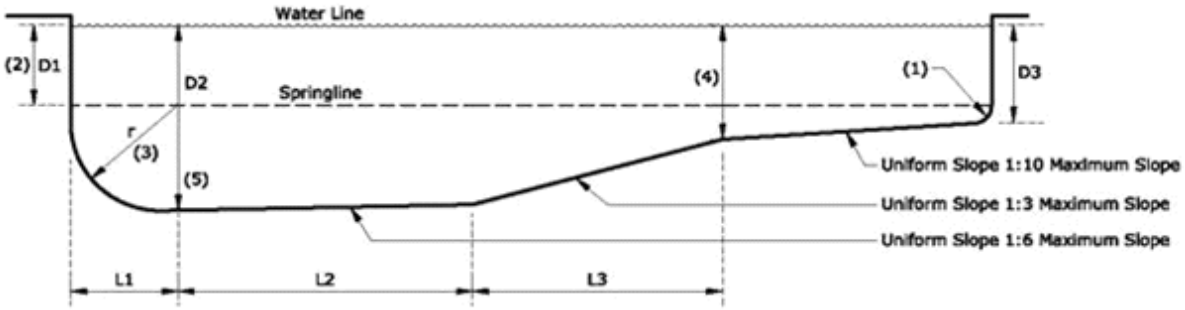
FIGURE 31B-3-DEPTHS AND CLEARANCES FOR POOLS WITHOUT DIVING BOARDS

LONGITUDINAL SECTION



TRANSVERSE SECTION AT D2

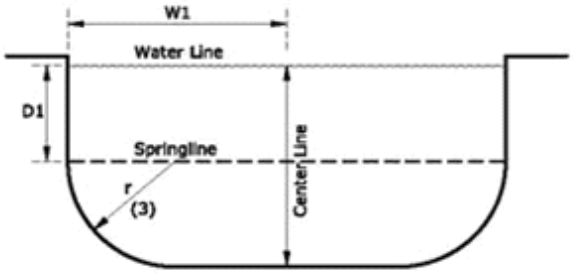


TABLE 31B-3A-POOLS WITH MAXIMUM WATER DEPTH ≤ 6′0″							
	DEPTH OF WATER			LENGTH OF SECTION			
DIMENSION	D1	D2	D3	L1	L2	L3	W1
Minimum	2′-6″	—	0′-0″	3′-6″	3′-0″	3′-0″	6′-0″
Maximum	—	6′-0″	3′-6″	—	—	—	—

TABLE 31B-3B-POOLS WITH MAXIMUM WATER DEPTH > 6′0″						
	DEPTH OF WATER			LENGTH OF SECTION		
DIMENSION	D1	D2	D3	L1	L2	W1
Minimum	2′-6″	> 6′-0″	0′-0″	3′-6″	3′-0″	7′-6″
Maximum	—	—	3′-6″	—	—	—

Notes for Figure 31B-3 and Tables 31B-3a and 31B-3b.

1. *Radius at the shallow end shall be a maximum of 1′-0″.*
2. *Springline D1 shall extend to the break in slope between the shallow area and deep area.*
3. *Maximum radius shall equal D2 minus D1 dimensions.*
4. *Where there is a break in slope, the break shall be located at a water depth equal to 4′-6″.*
5. *Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.*

SECTION 3135B—GAS CHLORINATION EQUIPMENT ROOM

Compressed chlorine gas storage containers and auxiliary components shall be installed indoors in a separate room of not less than 1-hour fire resistant construction and shall comply with the California Fire Code and all of the following.

3135B.1 Location. *The gas chlorination equipment room shall not be located in any habitable building, above the first floor or below ground level.*

3135B.2. Exit. *Required exit doors shall swing in the direction of exit of travel and shall not open directly toward the pool or pool deck.*

3135B.3 Ventilation. *Mechanical exhaust ventilation systems shall be in compliance with the California Mechanical Code.*

3135B.4 Alarm. *An audible and visible chlorine detection alarm system shall be located in the room containing the gas chlorine equipment. The sensor shall be located within 6 inches (152 mm) of the floor level. The system shall continually monitor the room and shall activate when chlorine concentrations in the room exceed a Permissible Exposure Limit of 0.5 ppm. Activation of the alarm shall shut off the chlorine at the source and turn on the lights and ventilation system. The alarm system shall consist of the following:*

1. *An audible alarm capable of producing a sound level of at least 90 decibels; and*
2. *A visible alarm consisting of a strobe light which is mounted directly over the entrance to the chlorine equipment room. The light shall be visible during daylight hours.*

3135B.5 Illumination. *Artificial illumination of at least 50 footcandles as measured 30 inches (750 mm) from the floor shall be provided in the room.*

3135B.6 Switches. *Switches for the control of mechanical ventilation and lighting fixtures shall be located adjacent to the entry door outside the room.*

3135B.7 Equipment interlocks. *The gas chlorine feeding device shall be interlocked with the pool recirculating pump so that the gas chlorine feeding device shall not operate when the recirculating pump is off or during the filter backwash.*

3135B.8 Storage. *The gas chlorine room shall not be used for the storage of items not related to the use of the gas chlorine equipment.*

SECTION 3136B—POOL SKIMMING SYSTEMS

The pool shall be equipped with one or more skimming methods to provide continuous skimming of the pool water and shall be capable of continually withdrawing not less than 100 percent of the flow rate.

3136B.1 Surface skimmers. *Each surface skimmer shall comply with the following provisions:*

1. *The skimmer shall be recessed into the pool wall; and*
2. *The skimmer shall be individually adjustable for the rate of flow with either an external or internal device; and*
3. *If used, a skimmer equalizer suction outlet shall be connected to at least two suction grate assemblies that meet the ANSI/APSP-16 2011 performance standard and are located at least 3 feet (915 mm) apart in any dimension between the suction outlets; and*
4. *The skimmer weir shall automatically adjust to variations in the pool water level over a range of not less than 4 inches (102 mm); and*
5. *Each skimmer shall be provided with a removable and cleanable screen or basket to trap objects. The screen or basket shall be accessible through an opening in the deck above the skimmer; and*
6. *There shall be a minimum of one skimmer for every 500 square feet or less of pool water surface area or an adequate number to meet 100 percent of pump flow at the manufacturer's maximum flow rating, whichever is greater; and*
7. *Each skimmer shall be located in relation to pool inlets to aid recirculation and surface skimming; and*
8. *All surface skimmers shall comply with applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.*

3136B.2 Perimeter overflow systems. *A perimeter overflow system shall be required in pools whose water surface area equals or exceeds 5,000 square feet (464.52 m^2). Perimeter overflow systems shall be designed by an engineer or architect who has experience working on public pools and shall comply with the following provisions:*

1. ***Location.*** *The overflow system shall be integrated with the pool structure and extend completely around the pool parallel to the pool deck except where an entry or exit may require interruption; and*
2. ***Channel detail.*** *The overflow channel shall be not less than 3 inches (76 mm) deep, the section shall not diverge with depth of the channel, and the width of the bottom shall be not less than 3 inches (76 mm). The opening beneath the coping into the overflow system shall be a minimum of 4 inches (102 mm) beneath the coping in any direction measured radially from the inner edge of the overflow channel lip; and*
3. ***Channel lip.*** *The overflow channel lip shall be not more than 12 inches (305 mm) below the level of the coping or deck. The lip edge shall be rounded and shall be not thicker than $2^1/_2$ inches (64 mm) or thinner than 1 inch (25 mm) for the top 2 inches (51 mm); and*
4. ***Channel covering.*** *Covered overflow channels shall be permitted provided the openings do not exceed $^1/_2$ inch in the smaller dimension; and*
5. ***Channel outlets.*** *Channel outlet spacing and channel bottom slope shall be hydraulically designed by an engineer or architect who has experience working on public pools; and*

6. ***Channel outlet covers.*** *Overflow channel outlet covers shall be accessible for cleaning and maintenance. Openings of the channel outlet covers shall not pass a $^1/_2$ inch (13 mm) sphere in the smaller dimension; and*
7. ***Channel drain piping.*** *Channel drain piping shall provide drainage of the overflow system, carry overflow water to a surge basin and return to skimming within 10 minutes after being flooded by a sudden displacement of the pool water by pool users; and*
8. ***Surge storage capacity.*** *A perimeter overflow system shall be provided with a minimum surge storage capacity of not less than 1 gallon per square foot (40.75 L/m^2) of pool water surface area. Surge storage shall be permitted in the surge basin, perimeter overflow channel and in the channel drain piping returning to the surge basin.*

SECTION 3137B—POOL FITTINGS

3137B.1 Outlets. *Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of a pool that conducts water to a recirculating pump. Suction outlets shall comply with all of the following provisions:*

1. *Each pump on a pool system shall be connected to at least two suction outlets. The suction outlets shall be hydraulically balanced and symmetrically plumbed through one or more "T" fittings and shall be separated by a distance of at least 3 feet (915 mm) in any dimension between the suction outlets; and*
2. *All suction outlets shall be equipped with suction fittings that meet the ANSI/APSP-16 2011 performance standard; and*
3. *The velocity of the suction piping installed between the suction outlets shall not exceed 3 feet per second (.91 mps) under normal operation, or 6 feet per second (1.82 mps) if one outlet is blocked; and*
4. *Hydrostatic relief devices. In areas with a high groundwater table, or as required by local plumbing codes, a hydrostatic relief device shall be installed. When used in conjunction with a safety vacuum release system, the hydrostatic relief device must meet the manufacturer's installation requirements for the safety vacuum release system.*

   Exception: *Alternative outlet locations that have been designed by a licensed engineer who has experience working on public pools may be used if approved by the enforcing agent.*

3137B.2 Inlet fittings. *Each pool shall be provided with not less than two recirculation system inlets for the first 10,000 gallon (37,850 L) capacity and one additional inlet for each additional 10,000 gallon (37,850 L) or less capacity.*

3137B.2.1 Construction. *Inlet fittings shall not protrude greater than $1^1/_4$ inches (32 mm) into the pool and shall be shaped, rounded and smooth.*

3137B.2.2 Location. *Inlet fittings shall be located no less than 18 inches (457 mm) below the waterline, except for a spa pool or wading pool. Inlet fittings shall be separated by at least 10 feet (3048 mm) and shall be located so as to ensure uniform circulation.*

3137B.2.3 Adjustment. *Provisions shall be made for adjusting the volume of flow through each inlet. Wall inlets shall be capable of adjusting the direction of flow and to produce sufficient velocity to impart a substantial circulatory movement to the pool water.*

3137B.2.4 Floor inlets. *Pools that are greater than 40 feet (12,192 mm) in width or 3,000 square feet (278.7 mm^2) in surface area shall have floor-mounted return inlets. The number of floor inlets shall be in compliance with Section 3137B.2. All floor inlet fittings shall be located to provide uniform circulation and shall be installed so as to be flush with the surface of the pool bottom.*

SECTION 3138B—SPA POOL SPECIAL REQUIREMENTS

3138B.1 Aeration system. *A spa pool aeration and/or jet system shall be completely separate from the recirculation system and shall not be interconnected with any other pool.*

3138B.2 Maximum operating temperature. *The allowable water temperature of a spa pool shall not exceed 104° F (40° C).*

3138B.3 Surface area. *The water surface area of a spa pool shall not exceed 250 square feet (23.23 m^2).*

3138B.4 Maximum depth. *The water depth in a spa pool shall not exceed 4 feet (1220 mm).*

3138B.5 Emergency shut off switch. *A clearly labeled emergency shut off switch for the control of both the recirculation system and the aeration and/or jet system shall be installed adjacent to the spa pool.*

SECTION 3139B—SOLAR HEATING INSTALLATIONS

3139B.1 *Solar heating systems shall comply with the following:*

1. *Solar heating system suction outlets shall comply with Section 3137B; and*
2. *Solar heating system suction outlets shall be located no closer than 5 feet (1525 mm) to any pool inlet fitting; and*
3. *The installation of a solar heating system on a new or existing pool shall not interfere with the required turnover rate as specified in Section 3124B nor exceed the pipe flow velocities as specified in Section 3125B.1.*

SECTION 3140B—CLEANING SYSTEMS

A vacuum cleaning system shall be available which is capable of removing sediment from all parts of the pool floor. A cleaning system using potable water shall be protected by a backflow prevention device in accordance with Chapter 6 of the California Plumbing Code. No cleaning system shall operate in the pool when the pool is open or available for use by pool users. Built-in vacuum suction lines shall not be installed in the pool.

SECTION 3141B—WASTEWATER DISPOSAL

3141B.1 General requirements. *Material cleaned from filters and backwash water from any recirculation system shall be disposed in a manner that is acceptable to the local wastewater agency and will not create a nuisance. Backwash water shall not be returned to a pool. Pipes carrying wastewater from pools including pool drainage and backwash from filters shall be installed as an indirect waste in accordance with the requirements of Chapter 8 of the California Plumbing Code. Where a pump is used to discharge waste pool water to the drainage system, the pump discharge shall be installed as an indirect waste.*

3141B.2 Diatomaceous earth filters. *The backwash from a diatomaceous earth filter shall discharge into a separation tank that has been installed to collect the waste diatomaceous earth mixture. The wastewater from the separation tank shall discharge into a sanitary sewer or other disposal system acceptable to the local wastewater agency.*

3141B.3 Piping. *Sumps and drain piping shall have sufficient capacity to receive recirculation system backwash without overflow of the sump receiver. The sump shall not permit sewage to enter the surge basin or the pool in the event of a sewage backup*

3141B.4 Visual indicator. *Where direct observation of the backwash discharge is not visible to the operator during backwash operations, a sight glass shall be installed on the wastewater discharge line.*

3141B.5 Prohibited connection. *There shall be no direct connection between the pool, its recirculation system or overflow drain to any sanitary sewer, storm drain or drainage system.*

SECTION 3142B—RESERVED

SECTION 3143B—RESERVED

SECTION 3144B—RESERVED

SECTION 3145B—RESERVED

SECTION 3146B—RESERVED

SECTION 3147B—RESERVED

SECTION 3148B—RESERVED

SECTION 3149B—RESERVED

SECTION 3150B—RESERVED

SECTION 3151B—RESERVED

SECTION 3152B—RESERVED

SECTION 3153B—RESERVED

SECTION 3154B—RESERVED

SECTION 3155B—RESERVED

SECTION 3156B—RESERVED

SECTION 3157B—RESERVED

SECTION 3158B—RESERVED

SECTION 3159B—RESERVED

Division II – PUBLIC SWIMMING POOLS

Note: *These building standards are in statute but have not been adopted through the regulatory process. Enforcement of these standards set forth in this section does not depend upon adoption of regulations; therefore, enforcement agencies shall enforce the standards pursuant to the timeline set forth in this section prior to adoption of related regulations.*

SECTION 3160B—GROUND FAULT CIRCUIT INTERRUPTERS

1. *"Public swimming pool," as used in this section, means any swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a private club, including any swimming pool located on the grounds of a hotel, motel, inn, an apartment complex or any residential setting other than a single-family home. For purposed of this section, "public swimming pool" shall not include a swimming pool located on the grounds of a private single-family home, or a swimming pool owned or operated by the state or any local governmental entity as set forth in Section 116049 of the Health and Safety Code.*
2. *All dry-niche light fixtures, and all underwater wet-niche light fixtures operating at more than 15 volts in public swimming pools, as defined in this section, shall be protected by a ground fault circuit interrupter in the branch circuit, and all light fixtures in public swimming pools shall have encapsulated terminals.*
3. *Any public swimming pool that does not meet the requirements specified in Item 2 by January 1, 1998, shall be retrofitted to comply with these requirements by July 1, 1998.*
4. *The ground-fault circuit interrupter required pursuant to this section shall comply with Underwriter's Laboratory standards.*
5. *The owner or operator of a public swimming pool shall have its public swimming pool inspected by a qualified inspector on or before September 1, 1998, to determine compliance with this section.*
6. *All electrical work required for compliance with this section shall be performed by an electrician licensed pursuant to Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code.*

Authority: Health and Safety Code Section 116064 (e)
Reference: Health and Safety Code Section 116049 SB 1360, (Statutes 1995, c. 415).

SECTION 3161B—WADING POOLS

1. *"Public wading pool" means a pool that meets all of the following criteria:*
   - *1.1. It has a maximum water depth not exceeding 18 inches (457 mm).*
   - *1.2. It is a pool other than a pool that is located on the premises of a one-unit or two-unit residence, intended solely or the use of the residents or guests.*
2. *"Public wading pool" includes, but is not limited to, a pool owned or operated by private persons or agencies, or by state or local governmental agencies.*
3. *"Public wading pool" includes, but is not limited to, a pool located in an apartment house, hotel or similar setting that is intended for the use of residents or guests.*
4. *"Alteration" means any of the following:*
   - *4.1. To change, modify or rearrange the structural parts or the design.*
   - *4.2. To enlarge.*
   - *4.3. To move the location of.*
   - *4.4. To install a new water circulation system.*
   - *4.5. To make any repairs costing fifty dollars ($50) or more to an existing circulation system.*
5. *A public wading pool shall have at least two circulation drains per pump that are hydraulically balanced and symmetrically plumbed through one or more T fittings, and are separated by a distance of at least 3 feet (914 mm) in any dimension between drains.*
6. *All public wading pool main drain suction outlets that are under 12 inches (305 mm) across shall be covered with antivortex grates or similar protective devices. All main drain suction outlets shall be covered with grates or antivortex plates that cannot be removed except with the use of tools. Slots or openings in the grates or similar protective devices shall be of a shape, area and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.*
7. *The maximum velocity in the pump suction hydraulic system shall not exceed 6 feet per second (1.8 m/s) when 100 percent of the pump's flow comes from the main drain system and any main drain suction fitting in the system is completely blocked.*
8. *On or after January 1, 1998, all newly constructed public wading pools shall be constructed in compliance with this section.*

9. *Commencing January 1, 1998, whenever a construction permit is issued for alteration of an existing public wading pool, it shall be retrofitted so as to be in compliance with this section.*
10. *By January 1, 2000, every public wading pool, regardless of the date of original construction, shall be retrofitted to comply with this section.*

Authority: Health and Safety Code Section 116064 (e)
Reference: Health and Safety Code Section 116064 AB 2114, (Statues 1995, c. 415).

SECTION 3162B—ANTI-ENTRAPMENT DEVICES AND SYSTEMS

1. *The Legislature finds and declares that the public health interest requires that there be uniform statewide health and safety standards for public swimming pools to prevent physical entrapment and serious injury to children and adults. It is the intent of the Legislature to occupy the whole field of health and safety standards for public swimming pools and the requirements established in this article and the regulations adopted pursuant to this article shall be exclusive of all local health and safety standards relating to public swimming pools.*
2. *As used in this section, the following words have the following meanings:*
   - *(a) "ANSI/APSP performance standard" means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).*
   - *(b) "ASME/ANSI performance standard" means a standard that is accredited by the American National Standards Institute and published by the American Society of Mechanical Engineers.*
   - *(c) "ASTM performance standard" means a standard that is developed and published by ASTM International.*
   - *(d) "Public swimming pool" means an outdoor or indoor structure, whether in-ground or above- ground, intended for swimming or recreational bathing, including a swimming pool, hot tub, spa or nonportable wading pool, that is any of the following:*
     - *(i) Open to the public generally, whether for a fee or free of charge.*
     - *(ii) Open exclusively to members of an organization and their guests, residents of a multiunit apartment building, apartment complex, residential real estate development or other multifamily residential area, or patrons of a hotel or other public accommodations facility.*
     - *(iii) Located on the premises of an athletic club, or public or private school.*
   - *(e) "Qualified individual" means a contractor who holds a current valid license issued by the State of California or a professional engineer licensed in the State of California who has experience working on public swimming pools.*
   - *(f) "Safety vacuum release system" means a vacuum release system that ceases operation of the pump, reverses the circulation flow, or otherwise provides a vacuum release at a suction outlet when a blockage is detected.*
   - *(g) "Skimmer equalizer line" means a suction outlet located below the waterline, typically on the side of the pool, and connected to the body of a skimmer that prevents air from being drawn into the pump if the water level drops below the skimmer weir. However, a skimmer equalizer line is not a suction outlet for purposes of Subdivisions (4) and (6).*
   - *(h) "Suction outlet" means a fitting or fixture of a swimming pool that conducts water to a recirculating pump.*
   - *(i) "Unblockable suction outlet" means a suction outlet, including the sump, that has a perforated (open) area that cannot be shadowed by the area of the 18-inch by 23-inch body blocking element of the ANSI/APSP-16 performance standard, and that the rated flow through any portion of the remaining open area cannot create a suction force in excess of the removal force values in Table 1 of that standard.*
3. *Subject to Subdivision (6), every public swimming pool shall be equipped with anti-entrapment devices or systems that comply with ANSI/APSP-16 performance standard or successor standard designated by the Federal Consumer Product Safety Commission.*
   - *a. A public swimming pool that has a suction outlet in any location other than on the bottom of the pool shall be designed so that the recirculation system shall have the capacity to provide a complete turnover of pool water within the following time:*
     - *(i) One-half hour or less for a spa pool.*
     - *(ii) One-half hour or less for a spray ground.*
     - *(iii) One hour or less for a wading pool.*
     - *(iv) Two hours or less for a medical pool.*
     - *(v) Six hours or less for all other types of public pools.*
4. *Subject to Subdivisions (5) and (6), every public swimming pool with a single suction outlet that is not an unblockable suction outlet shall be equipped with at least one or more of the following devices or systems that are designed to prevent physical entrapment by pool drains:*
   - *(a) A safety vacuum release system that has been tested by a nationally recognized testing laboratory and found to conform to ASME/ANSI Performance Standard A112.19.17, as in effect on December 31, 2009, or ASTM Performance Standard F2387, as in effect on December 31, 2009.*
   - *(b) A suction-limiting vent system with a tamper-resistant atmospheric opening, provided that it conforms to any applicable ASME/ANSI or ASTM performance standard.*

(c) *A gravity drainage system that utilizes a collector tank, provided that it conforms to any applicable ASME/ANSI or ASTM performance standard.*

(d) *An automatic pump shut-off system tested by a department-approved independent third party and found to conform to any applicable ASME/ANSI or ASTM performance standard.*

(e) *Any other system that is deemed, in accordance with federal law, to be equally effective as, or more effective than, the systems described in paragraph (a) at preventing or eliminating the risk of injury or death associated with the circulation system of the pool and suction outlets.*

5. *Every public swimming pool constructed on or after January 1, 2010, shall have at least two suction outlets per pump that are hydraulically balanced and symmetrically plumbed through one or more "T" fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets. A public swimming pool constructed on or after January 1, 2010, that meets the requirements of this subdivision, shall be exempt from the requirements of Subdivision (4).*

6. *A public swimming pool constructed prior to January 1, 2010, shall be retrofitted to comply with Subdivisions (3) and (4) by no later than July 1, 2010, except that no further retrofitting is required for a public swimming pool that completed a retrofit between December 19, 2007, and January 1, 2010, that complied with the Virginia Graeme Baker Pool and Spa Safety Act (15 U.S.C. Sec. 8001 et seq.) as in effect on the date of issue of the construction permit, or for a nonportable wading pool that completed a retrofit prior to January 1, 2010, that complied with state law on the date of issue of the construction permit. A public swimming pool owner who meets the exception described in this subdivision shall do one of the following prior to September 30, 2010:*

   a. *File the form issued by the department pursuant to subdivision (g), as otherwise provided in subdivision (h).*

   b. *File a signed statement attesting that the required work has been completed.*

   c. *Provide a document containing the name and license number of the qualified individual who completed the required work.*

   d. *Provide either a copy of the final building permit, if required by the local agency, or a copy of one of the following documents if no permit was required:*

      (i) *A document that describes the modification in a manner that provides sufficient information to document the work that was done to comply with federal law.*

      (ii) *A copy of the final paid invoice. The amount paid for the services may be omitted or redacted from the final invoice prior to submission.*

7. *Prior to March 31, 2010, the department shall issue a form for use by an owner of a public swimming pool to indicate compliance with this section. The department shall consult with county health officers and directors of departments of environmental health in developing the form and shall post the form on the department's Internet Web site. The form shall be completed by the owner of a public swimming pool prior to filing the form with the appropriate city, county, or city and county department of environmental health. The form shall include, but not be limited to, the following information:*

   a. *A statement of whether the pool operates with a single suction outlet or multiple suction outlets that comply with Subdivision (5).*

   b. *Identification of the type of anti-entrapment devices or systems that have been installed pursuant to Subdivision (4) and the date or dates of installation.*

   c. *Identification of the type of devices or systems designed to prevent physical entrapment that have been installed pursuant to Subdivision (4) in a public swimming pool with a single suction outlet that is not an unblockable suction outlet and the date or dates of installation or the reason why the requirement is not applicable.*

   d. *A signature and license number of a qualified individual who certifies that the factual information provided on the form in response to paragraphs (a) to (c), inclusive, is true to the best of his or her knowledge.*

8. *A qualified individual who improperly certifies information pursuant to Paragraph (d) of Subdivision (7) shall be subject to potential disciplinary action at the discretion of the licensing authority.*

9. *Except as provided in Subdivision (6), each public swimming pool owner shall file a completed copy of the form issued by the department pursuant to this section with the city, county, or city and county department of environmental health in the city, county, or city and county in which the swimming pool is located. The form shall be filed within 30 days following the completion of the swimming pool construction or installation required pursuant to this section or, if the construction or installation is completed prior to the date that the department issues the form pursuant to this section, within 30 days of the date that the department issues the form. The public swimming pool owner or operator shall not make a false statement, representation, certification, record, report or otherwise falsify information that he or she is required to file or maintain pursuant to this section.*

10. *In enforcing this section, health officers and directors of city, county, or city and county departments of environmental health shall consider documentation filed on or with the form issued pursuant to this section by the owner of a public swimming pool as evidence of compliance with this section. A city, county, or city and county department of environmental health may verify the accuracy of the information filed on or with the form.*

11. *To the extent that the requirements for public wading pools imposed by Section 116064 conflict with this section, the requirements of this section shall prevail.*

12. *The department shall have no authority to take any enforcement action against any person for violation of this section and has no responsibility to administer or enforce the provisions of this section.*

Authority: Health and Safety Code Section 116064 (e)
Reference: Health and Safety Code Section 116064.2 AB 2114, (Statutes 2012, c. 679).

FIGURE 31B-4—PERPENDICULAR FENCING DIMENSIONS ON SLOPING GROUND

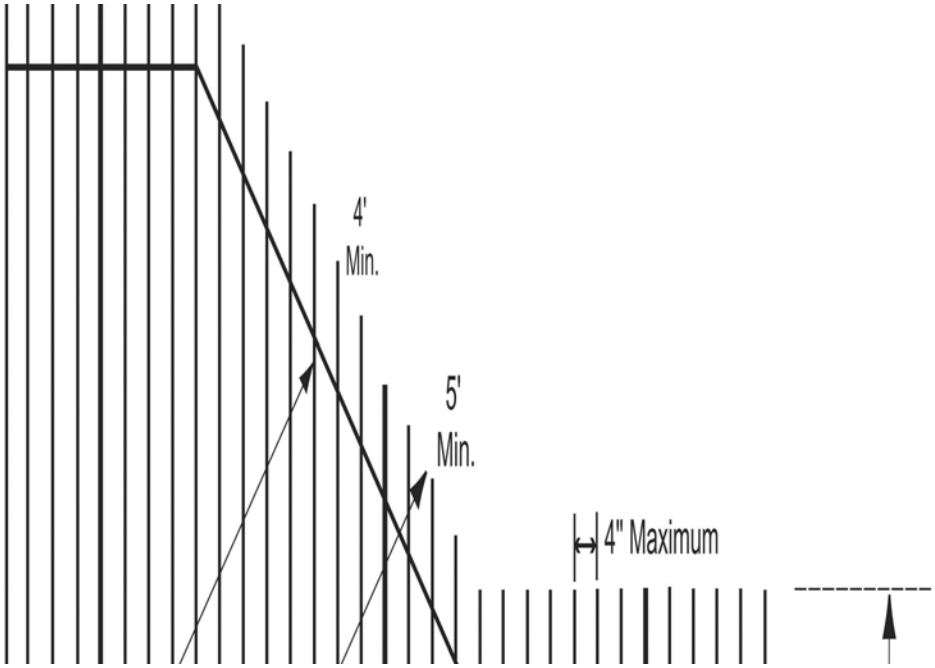


FIGURE 31B-5—EFFECTIVE FENCING HEIGHT

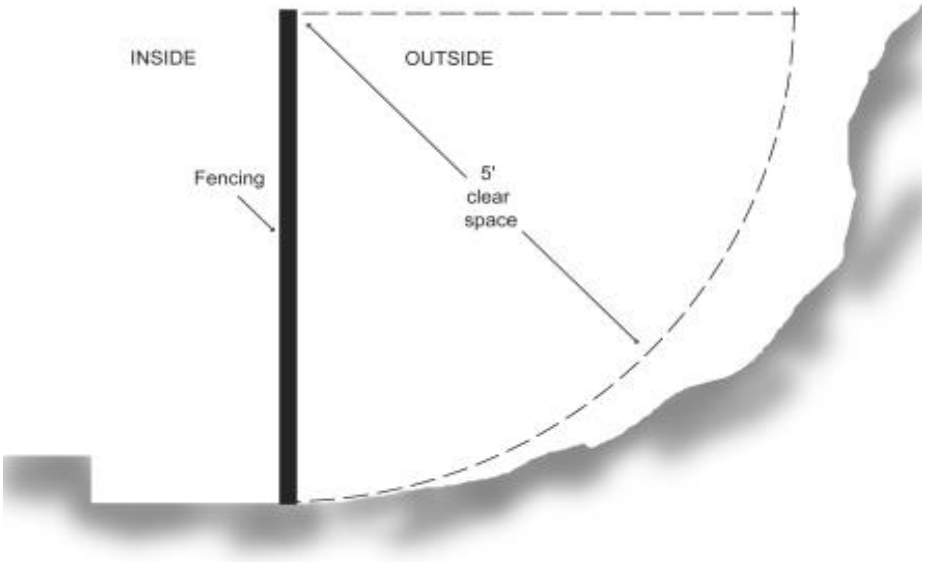


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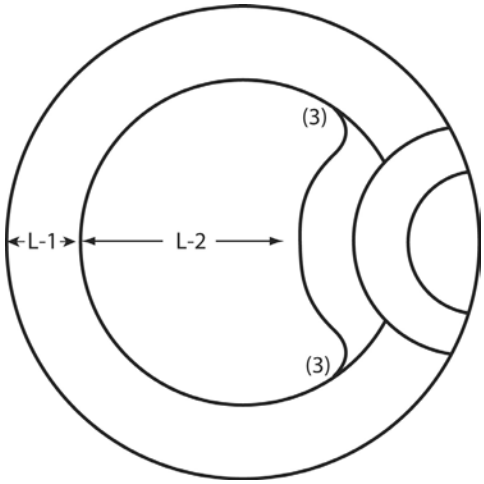
FIGURE 31B-6
DEPTHS AND DIMENSIONS FOR SPA POOLS

TOP VIEW



TRANSVERSE SECTION

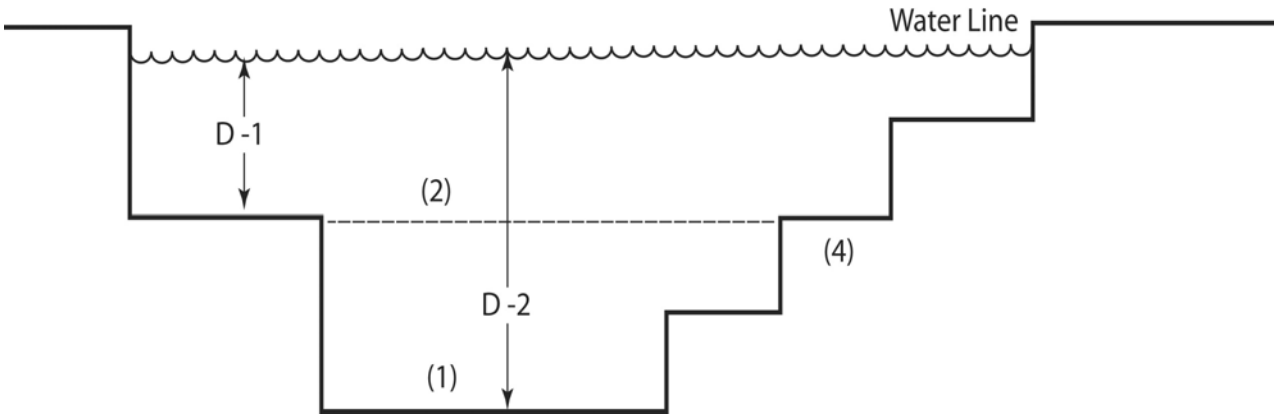
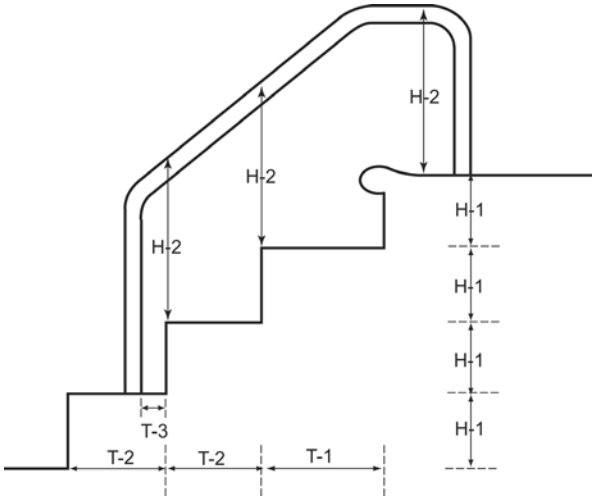


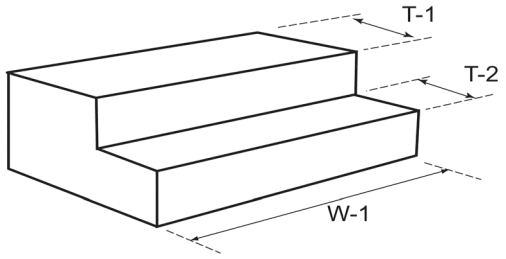
TABLE 31B-6				
	DEPTH OF WATER		LENGTH OF SECTION	
DIMENSION	D1	D2	L1	L2
Minimum	—	24"	12"	24"
Maximum	24"	—	24"	—

Notes for Figure 31B-6 and Table 31B-6:

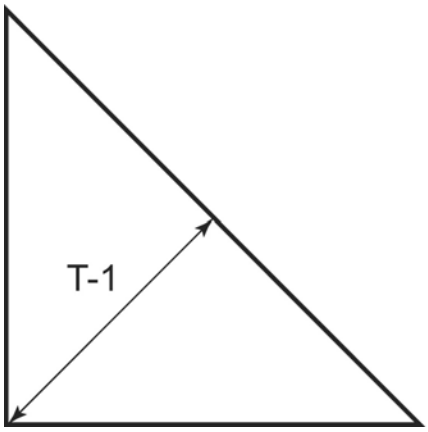
1. *Bottom slope shall not exceed 1:10 and must be uniform.*
2. *Bench ramping shall not exceed 1:10 uniform slope, measured at the inner circumference of the bench.*
3. *Six inch minimum radius at "pinch points."*
4. *See Section 3111B for step and handrail dimensions.*

FIGURE 31B-7-—STAIR AND HANDRAIL DIMENSIONS

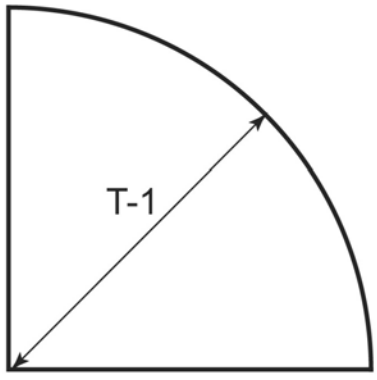




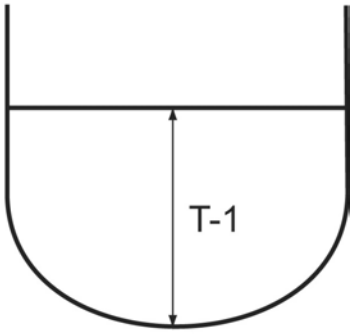
Standard Step



Triangular Step



Corner Step



Concave Step

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TABLE 31B-7							
DIMENSION	T-1 STANDARD	T-1 TRIANGULAR, CONCAVE, CONVEX	T-2	T-3	W-1	H-1	H-2
Minimum	14"	21"	12"	3"	24"	6"	28"
Maximum	18"	24"	16"	—	—	12"	36"

Note for Table 31B-7:
1. Six-inch minimum radius at “pinch points”.

FIGURE 31B-8—DEPTH MARKER LOCATIONS

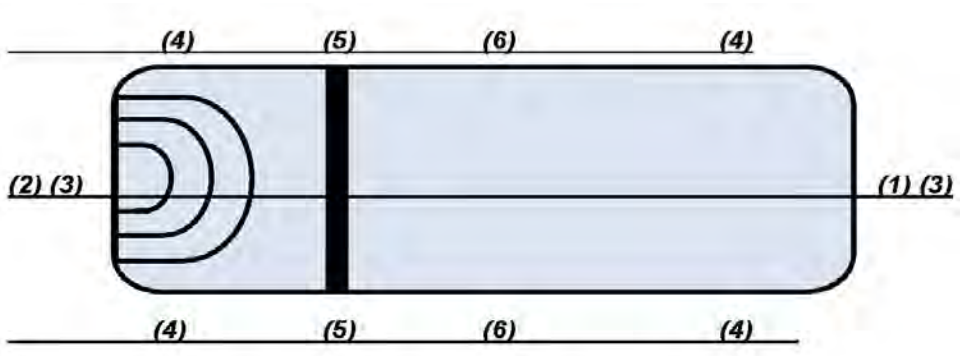

FIGURE 31B-8—DEPTH MARKER LOCATIONS

Notes
1. Maximum depth.
2. Minimum depth.
3. Each end of pool.
4. Both sides at the shallowest and deepest parts of pool.
5. At the break in the bottom slope between the shallow and deep end.
6. Along the perimeter of the pool at distances not to exceed 25 feet.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 31C – RADIATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																		X						
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

31C [DPH] RADIATION

SECTION 3101C—SCOPE

For the purpose of this chapter, the following terms shall have the meaning indicated:

***PRIMARY PROTECTIVE BARRIER** is a barrier to attenuate the useful beam.*

***SECONDARY PROTECTIVE BARRIER** is a barrier to attenuate stray radiation.*

***STRAY RADIATION** is radiation not serving any useful purpose, which includes leakage and scattered radiation.*

***USEFUL BEAM** is the radiation which passes through the window, aperture, cone or other collimating device of the tube housing.*

SECTION 3102C—RADIATION SHIELDING BARRIERS

All radiation shielding barriers in rooms and enclosures housing machines shall meet the requirements of Section 12-31C-101, Chapter 12-31C, Part 12, California Referenced Standards Code. The Department of Health Services is the only agency that may grant a variance or exception to these standards.

SECTION 3103C—MEDICAL RADIOGRAPHIC AND PHOTOFLUOROGRAPHIC INSTALLATIONS

***3103C.1 Operator station.** The operator's station at the control shall be behind a protective barrier either in a separate room, in a protected booth or behind a shield which will intercept the useful beam and any radiation which has been scattered only once.*

***3103C.2 Patient observation and communication.** Provision shall be made for the operator to observe and communicate with the patient without leaving the shielded position at the control panel. When an observation window is used, it must provide radiation attenuation equal to that required in the surrounding barrier.*

SECTION 3104C—MEDICAL THERAPEUTIC X-RAY INSTALLATIONS

***3104C.1 General.** All wall, floor and ceiling areas that can be struck by the useful beam, plus a border of 1 foot (305 mm), shall be provided with primary protective barriers.*

***3104C.2 Equipment operating above 50 kVp.** Equipment operating above 50 kVp shall conform with the following:*

1. *The control station shielding shall either be an integral part of the building or anchored to the building.*
2. *The control station shall be provided with a window having radiation attenuation equal to that required by the adjacent barrier, or a mirror system, or a closed-circuit television viewing screen. The patient area must be visible to the operator without having to leave the protected area during exposure.*

***3104C.3 Equipment operating above 150 kVp.** Equipment operating above 150 kVp shall conform to the following:*

1. *The treatment room shall be provided with interlocks so that when any door of the treatment room is opened, either the machine will shut off automatically or the radiation level within the room will be reduced to an average of not more than 2 milliroentgens per hour and a maximum of 10 milliroentgens per hour at a distance of one meter in any direction from the target. After such shutoff or reduction in output, it shall be possible to restore the machine to full operation only from the control panel.*
2. *The control station shall be within a protective booth or in an adjacent room.*

***3104C.4** A minimum of one door shall be provided with an auxiliary means for being opened in case of power failure or mechanical breakdown, where large power-driven doors offer the only access to the room.*

***3104C.5** A flashing red warning signal light energized only when the useful beam is on shall be located adjacent to the entrance(s) to a therapy room with equipment capable of operating above 500 kVp.*

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 31D – FOOD ESTABLISHMENTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter								X	X									X						
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

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CHAPTER

31D [DPH] FOOD ESTABLISHMENTS

SECTION 3101D—SCOPE

The provisions of this chapter shall apply to the construction of commissaries serving mobile food preparation units.

SECTION 3102D—DEFINITION

For the purpose of this chapter, the following term shall have the meaning indicated:

COMMISSARIES SERVING MOBILE FOOD PREPARATION UNITS *are food establishments in which food, containers, equipment or supplies are stored or handled for use in vehicles, mobile food preparation units, food carts or vending machines.*

SECTION 3103D—BUILDINGS AND STRUCTURES

3103D.1 Light. *Ten foot candles (107.6 lux) of uniformly distributed light as measured 30 inches (762 mm) above the floor shall be provided in all rooms and areas in commissaries serving mobile food preparation units.*

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CHAPTER

31E [DPH] RESERVED

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 31F – MARINE OIL TERMINALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								X
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

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CHAPTER

31F [SLC] MARINE OIL TERMINALS

DIVISION I

SECTION 3101F [SLC]—INTRODUCTION

3101F.1 Authority. *The Lempert-Keene-Seastrand oil spill prevention and response act of 1990 (act), as amended, authorizes the California State Lands Commission (SLC) to regulate marine terminals, herein referred to as marine oil terminals (MOTs), in order to protect public health, safety and the environment. The authority for this regulation is contained in Sections 8750 through 8760 of the California Public Resources Code. This act defines "oil" as any kind of petroleum, liquid hydrocarbons, or petroleum products or any fraction or residues thereof, including but not limited to, crude oil, bunker fuel, gasoline, diesel fuel, aviation fuel, oil sludge, oil refuse, oil mixed with waste and liquid distillates from unprocessed natural gas. The provisions of this chapter regulate onshore and offshore MOTs as defined under this act, including marine terminals that transfer liquefied natural gas (LNG).*

The Marine Environmental Protection Division (Division) administers this code on behalf of the SLC.

3101F.2 Purpose. *The purpose of this code is to establish minimum engineering, inspection and maintenance criteria for MOTs in order to prevent oil spills and to protect public health, safety and the environment. This code does not specifically address terminal siting, systems onboard vessels, processing facilities or operational requirements. Relevant provisions from existing codes, industry standards, recommended practices, regulations and guidelines have been incorporated directly or through reference, as part of this code.*

Where there are differing requirements between this code and/or references cited herein, the choice of application shall be subject to Division approval.

In circumstances where technologies proposed for use are not covered by this code and/or references cited herein, prevention of oil spills and equivalent or better protection of the public health, safety and the environment must be demonstrated, and the choice of application shall be subject to Division approval.

3101F.3 Applicability. *The provisions of this chapter are applicable to the evaluation of existing MOTs and design of new MOTs in California. Each provision is classified as New (N), Existing (E), or Both (N/E) and shall be applied accordingly. If no classification is indicated, the classification shall be considered to be (N/E).*

Existing (E) requirements apply to MOTs that were in operation on the date this code became effective (February 6, 2006). For these MOTs, equivalent or in-kind replacement of existing equipment, short pipeline sections or minor modification of existing components shall also be subject to the existing (E) requirements.

New (N) requirements apply to:

1. *A MOT or berthing system (Subsection 3102F.1.3) that commences or recommences operation with a new or modified operations manual after adoption of this code.*
2. *Addition of new structural components or systems at an existing MOT that are structurally independent of existing components or systems.*
3. *Addition of new (nonreplacement) equipment, piping, pipelines, components or systems to an existing MOT.*
4. *Major repairs or substantially modified in-place systems.*
5. *Any associated major installations or modifications.*

3101F.4 Overview. *This Code ensures that a MOT can be safely operated within its inherent structural and equipment-related constraints.*

Section 3102F defines minimum requirements for audit, inspection and evaluation of the structural, electrical and mechanical systems on a prescribed periodic basis, or following a significant, potentially damage-causing event.

Section 3103F, 3104F and 3107F provide criteria for structural loading, deformation and performance-based evaluation considering earthquake, wind, wave, current, seiche and tsunami effects.

Section 3105F provides requirements for the safe mooring and berthing of tank vessels and barges.

Section 3106F describes requirements for geotechnical hazards and foundation analyses, including consideration of slope stability and soil failure.

Section 3108F provides requirements for fire prevention, detection and suppression including appropriate water and foam volumes.

Sections 3109F through 3111F provide requirements for piping/ pipelines, mechanical and electrical equipment and electrical systems.

Section 3112F provides requirements specific to marine terminals that transfer LNG.

Generally, English units are typically prescribed herein; however, System International (SI) units are utilized in Section 3112F and in many of the references.

3101F.5 Spill prevention. *Each MOT shall utilize up-to-date Risk and Hazards Analysis results developed per CCPS "Guidelines for Hazard Evaluation Procedures" [1.1] and [1.2], to identify the hazards associated with operations at the MOT, including operator error, the use of the facility by various types of vessels (e.g., multi-use transfer operations), equipment failure and external events likely to cause an oil spill.*

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If there are changes made to the built MOT or subsequently any new hazard is identified with significant impact, the updated Risk and Hazards Analysis shall be used.

Assessed magnitude of potential oil spill releases and consequences shall be mitigated by implementing appropriate designs using best achievable technologies, subject to Division approval. The residual risks are addressed by operational and administrative means via 2 CCR 2385 [1.3].

Risk and Hazards Analysis requirements specific to marine terminals that transfer LNG are discussed in Section 3112F.2.

3101F.6 Oil spill exposure classification. *Each MOT shall be categorized into one of three oil spill exposure classifications (high, medium or low) as shown in Table 31F-1-1, based on all of the following:*

1. *Exposed total volume of oil (V_T) during transfer.*
2. *Maximum number of oil transfer operations per berthing system (defined in Section 3102F.1.3) per year.*
3. *Maximum vessel size (DWT capacity) that may call at the MOT.*

During a pipeline leak, a quantity of oil is assumed to spill at the maximum cargo flow rate until the ESD is fully effective. The total volume (V_T) of potential exposed oil is equal to the sum of the stored and flowing volumes ($V_s + V_F$) at the MOT, prior to the emergency shutdown (ESD) system(s) stopping the flow of oil. All potential spill scenarios shall be evaluated and the governing scenario clearly identified. The stored volume (V_s) is the non-flowing oil. The flowing volume (V_F) shall be calculated as follows:

Equation 1-1 $V_F = Q_C \times \Delta t \times (1/3{,}600)$

where*:*

V_F *= Flowing volume of potential exposed oil [bbl]*

Q_C *= Maximum cargo transfer rate [bbl/hr]*

Δt *= For MOTs that first transferred oil on or before January 1, 2017, Δt may be taken as (ESD time, 30 or 60 seconds). For MOTs that first transfer oil after January 1, 2017, Δt shall be taken as ((ESD closure time) + (time required to activate ESD)) [seconds].*

If spill reduction strategies, (e.g. pipeline segmentation devices, system flexibility and spill containment devices) are adopted, such that the maximum volume of exposed oil during transfer is less than 1,200 barrels, the spill classification of the facility may be lowered.

This classification does not apply to marine terminals that transfer LNG.

TABLE 31F-1-1—MOT OIL SPILL EXPOSURE CLASSIFICATION

SPILL CLASSIFICATION	EXPOSED TOTAL VOLUME OF OIL (V_T) (bbls)	MAXIMUM NUMBER OF TRANSFERS PER BERTHING SYSTEM PER YEAR	MAXIMUM VESSEL SIZE (DWT×1,000)
High	≥ 1200	N.A.	N.A.
Moderate	< 1200	≥ 90	≥ 30
Low	< 1200	< 90	< 30

3101F.7 Management of Change. *Whenever physical changes are made to the built MOT that significantly impact operations, a Management of Change (MOC) process shall be followed per Section 6.6 of API Standard 2610 [1.4].*

3101F.8 Review requirements.

3101F.8.1 Quality assurance. *All audits, inspections, engineering analyses or design shall be reviewed by a professional having similar or higher qualifications as the person who performed the work, to ensure quality assurance. This review may be performed in-house and shall include a concluding statement of compliance with this code.*

3101F.8.2 Peer review. *The Division may require peer review of advanced engineering analyses and designs, including, but not limited to, nonlinear dynamic structural analyses, alternative lateral force procedures, complex geotechnical evaluations, subsea pipeline analyses and designs and fatigue analyses. Peer review shall be performed by an external independent source to maintain the integrity of the process.*

The peer reviewer(s) and their affiliated organization shall have no other involvement in the project, except in a review capacity. The peer reviewer(s) shall be a California registered engineer(s) familiar with regulations governing the work and have technical expertise in the subject matter to a degree of at least that needed for the original work. The peer reviewer(s)' credentials shall be presented to the Division for approval prior to commencement of the review.

Upon completion of the review process, the peer reviewer(s) shall submit a written report directly to the Division that covers all aspects of the review process, including, but not limited to:

1. *Scope, extent and limitations of the review.*
2. *Status of the documents reviewed at each stage (i.e. revision number and date).*
3. *Findings.*
4. *Recommended corrective actions and resolutions, if necessary.*
5. *Conclusions.*
6. *Certification by the peer reviewer(s), including whether or not the final reviewed work meets the requirements of this code.*

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7. *Formal documentation of important peer review correspondence, including requests for information and written responses.*

The owner and operator shall cooperate in the review process, but shall not influence the peer review. If the original work requires modification after completion of the peer review, the final analyses and designs shall be submitted to the Division.

3101F.8.3 Division review. *The following will be subject to review for compliance with this code by the Division or its authorized representative(s):*

1. *Any audit, inspection, analysis or evaluation of MOTs.*
2. *Any significant change, modification or re-design of a structural, mooring, fire, piping/pipelines, mechanical or electrical system at an MOT, prior to use or reuse.*
3. *Engineering analysis and design for any new MOT prior to construction. Also see Section 3102F.3.3.1.*
4. *Construction inspection team and the construction inspection report(s).*

3101F.9 Alternatives. *In special circumstances where certain requirements of these standards cannot be met, alternatives that provide an equal or better protection of the public health, safety and the environment shall be subject to Division Chief approval with concurrence of the Division's lead engineer in responsible charge.*

3101F.10 Symbols.

DWT = Dead weight tonnage

Q_C = Maximum cargo transfer rate [bbl/hr]

V_F = Flowing volume of potential exposed oil [bbl]

V_S = Stored volume of potential exposed oil [bbl]

V_T = Total volume of potential exposed oil [bbl]

Δt = ESD closure and activation time (if applicable) [sec]

3101F.11 References.

[1.1] Center for Chemical Process Safety (CCPS), 2008, "Guidelines for Hazard Evaluation Procedures", 3rd ed., New York.

[1.2] California Code of Regulations (CCR), Title 14, Division 1, Chapter 3, Oil Spill Contingency Plans (14 CCR 815.01 through 818.03), Section 817.02(c)(1) – Risk and Hazard Analysis.

[1.3] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)

[1.4] American Petroleum Institute (API), 2005, API Standard 2610 (R2010), "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2nd ed., Washington, D.C.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code. Section 8670.28(a)(7), Government Code.*

DIVISION 2

SECTION 3102F—AUDIT AND INSPECTION

3102F.1 General.

3102F.1.1 Purpose. *Section 3102F defines minimum requirements for audit, inspection and evaluation of the structural, mechanical and electrical components and systems.*

3102F.1.2 Audit and inspections types. *The audit and inspections described in this Chapter (31F) are:*

1. *Annual compliance inspection*
2. *Audits*
3. *Post-event inspection*

Each has a distinct purpose and is conducted either at a defined interval (see Table 31F-2-1 and Section 3102F.3.3), for a significant change in operations, or as a result of a significant, potentially damage-causing event. In the time between audits and inspections, operators are expected to conduct periodic walk-down examinations of the MOT to detect potentially unsafe conditions.

TABLE 31F-2-1—MAXIMUM INTERVAL BETWEEN UNDERWATER INSPECTIONS (YEARS)[1]

INSPECTION CONDITION ASSESSMENT RATING (ICAR)[6]	CONSTRUCTION MATERIAL				CHANNEL BOTTOM OR MUDLINE—SCOUR[4]	
	Unwrapped Timber or Unprotected Steel (no coating or cathodic protection)[4]		Concrete, Wrapped Timber, Protected Steel or Composite Materials (FRP, plastic, etc.)[4]			
	Benign[2] Environment	Aggressive[3] Environment	Benign[2] Environment	Aggressive[3] Environment	Benign[2] Environment	Aggressive[3] Environment
6 (Good)	6	4	6	5	6	5
5 (Satisfactory)	6	4	6	5	6	5
4 (Fair)	5	3	5	4	6	5
3 (Poor)	4	3	5	4	6	5
2 (Serious)	2	1	2	2	2	2
1 (Critical)	N/A[5]	N/A[5]	N/A[5]	N/A[5]	N/A[5]	N/A[5]

1. *The maximum interval between Underwater Inspections shall be changed as appropriate, with the approval of the Division, based on the extent of deterioration observed on a structure, the rate of further anticipated deterioration or other factors.*
2. *Benign environments include fresh water and maximum current velocities less than 1.5 knots for the majority of the days in a calendar year.*
3. *Aggressive environments include brackish or salt water, polluted water or waters with current velocities greater than 1.5 knots for the majority of the days in the calendar year.*
4. *For most structures, two maximum intervals will be shown in this table, one for the assessment of construction material (timber, concrete, steel, etc.) and one for scour (last 2 columns). The shorter interval of the two should dictate the maximum interval used.*
5. *MOTs rated "Critical" will not be operational; and Emergency Action shall be required in accordance with Table 31F-2-6.*
6. *ICARs shall be assigned in accordance with Table 31F-2-4.*

3102F.1.3 Berthing systems. *For the purpose of assigning structural ratings and documenting the condition of mechanical and electrical systems, an MOT shall be divided into independent "berthing systems." A berthing system consists of the wharf and supporting structure, mechanical and electrical components that serve the berth and pipeline systems.*

For example, a MOT consisting of wharves with three berths adjacent to the shoreline could contain three independent "berthing systems" if the piping does not route through adjacent berths. Therefore, a significant defect that would restrict the operation of one berth would have no impact on the other two berths. Conversely, if a T-head Pier, with multiple berths sharing a trestle that supports all piping to the shoreline, had a significant deficiency on the common trestle, the operation of all berths could be adversely impacted. This configuration is classified as a single berthing system.

The physical boundaries of a berthing system may exclude unused sections of a structure. Excluded sections must be physically isolated from the berthing system. Expansion joints may provide this isolation.

3102F.1.4 Records. *All MOTs shall have records reflecting current, "as-built" conditions for all berthing systems. Records shall include, but not be limited to modifications and/or replacement of structural components, electrical or mechanical equipment or relevant operational changes, new construction including design drawings, calculations, engineering analyses, soil borings, equipment manuals, specifications, shop drawings, technical and maintenance manuals and documents.*

Chronological records and reports of annual inspections, audits and post-event inspections and documentation of equipment or structural changes shall be maintained.

Records shall be indexed and be readily accessible to the Division (see 2 CCR Section 2320 (c) (2)) [2.1].

3102F.1.5 Baseline assessment. *If "as-built" or subsequent modification drawings are not available, incomplete or inaccurate, a baseline inspection is required to gather data in sufficient detail for adequate evaluation.*

The level of detail required shall be such that structural member sizes, connection and reinforcing details are documented, if required in the structural analysis. In addition, the strength and/or ductility characteristics of construction materials shall be determined, as appropriate. Nondestructive testing, partially destructive testing and/or laboratory testing methods may be used.

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All fire, piping, mechanical and electrical systems shall be documented as to location, capacity, operating limits and physical conditions in the equipment layout diagram(s).

3102F.2 Annual compliance inspection. *The Division may carry out annual inspections to determine the compliance status of the MOT with this code, based on the terminal's audit and inspection findings and action plan implementation (see Section 3102F.3.9).*

These inspections may include a visual and tactile assessment of structural, mechanical and electrical systems of the topside and underside areas of the dock, including the splash zone. Subject to operating procedures, a boat shall be provided to facilitate the inspection of the dock undersides and piles down to the splash zone.

3102F.3 Audits.

3102F.3.1 Objective. *The objective of the audit is to review structural, mechanical and electrical systems on a prescribed periodic basis to verify that each berthing system is fit for its specific defined purpose. The audit includes above water and underwater inspections, engineering evaluation, documentation and recommended follow-up actions.*

3102F.3.2 Overview. *The audit shall include above water and underwater inspections, and structural, electrical and mechanical systems evaluations, with supporting documentation, drawings and follow-up actions. Structural systems shall include seismic, operational, mooring, berthing and geotechnical considerations. Mechanical systems shall include fire, piping/pipelines and mechanical equipment considerations. The audit is performed by a multi-disciplinary team of engineers, qualified inspectors and may include Division representatives.*

The above water inspection involves an examination of all structural, mechanical and electrical components above the waterline. Structural defects and their severity shall be documented, but the exact size and location of each deficiency is typically not required.

The underwater inspection involves an examination of all structural, mechanical and electrical components below the waterline. A rational and representative underwater sampling of piles may be acceptable with Division approval, for cases of limited visibility, heavy marine growth, restricted inspection times because of environmental factors (currents, water temperatures, etc.) or a very large number of piles.

Global operational structural assessment rating(s) (OSAR), global seismic structural assessment rating(s) (SSAR) and global inspection condition assessment rating(s) (ICAR) shall be assigned to each structure and overall berthing system, where appropriate (Table 31F-2-4).

Remedial action priorities (RAP) shall be assigned for component deficiencies (Table 31F-2-5). Recommendations for remediation and/or upgrading shall be prescribed as necessary.

An audit is not considered complete until the audit report is received (in electronic and hard copy formats) by the Division.

3102F.3.3 Schedule.

3102F.3.3.1 Initial audit. *For a new MOT or new berthing system(s), the initial audit of the "as-built" systems(s) shall be performed prior to commencement of operations.*

3102F.3.3.2 Subsequent audits. *A subsequent audit of each terminal shall be completed concurrently with the inspections (see Section 3102F.3.5). The audit team leader shall recommend either: (1) a default subsequent audit interval of 4 years, or (2) an alternate interval, based on assessments of the structural, mechanical and electrical systems, and consideration of:*

1. *The extent of the latest deterioration and/or disrepair,*
2. *The rate of future anticipated deterioration and/or disrepair,*
3. *The underwater inspection guidance provided in Table 31F-2-1, and*
4. *Other specified factors.*

Based on independent assessment of these factors, the Division may accept the audit team leader's recommendation or require a different subsequent audit interval.

If there are no changes in the defined purpose (see Section 3102F.3.6.1) of the berthing system(s), relevant prior analyses may be referenced. However, if there is a significant change in the operations or condition of berthing system(s), a new analysis may be required.

The Division may require an audit, inspection or supplemental evaluations to justify changes in the use of the berthing system(s).

3102F.3.4 Audit team.

3102F.3.4.1 Project manager. *The audit shall be conducted by a multidisciplinary team under the direction of a project manager representing the MOT. The project manager shall have specific knowledge of the MOT and may serve other roles on the audit team.*

3102F.3.4.2 Audit team leader. *The audit team leader shall lead the on-site audit team and shall be responsible for directing field activities, including the inspection of all structural, mechanical and electrical systems. The team leader shall be a California registered civil or structural engineer and may serve other roles on the audit team.*

3102F.3.4.3 Structural inspection team. *The structural inspection shall be conducted under the direction of a registered civil or structural engineer.*

All members of the structural inspection team shall be graduates of a 4-year civil/structural engineering, or closely related (ocean/coastal) engineering curriculum, and shall have been certified as an Engineer-in-Training; or shall be technicians who have completed a course of study in structural inspections. The minimum acceptable course in structural inspections shall include 80 hours of instruction specifically related to structural inspection, followed by successful completion of a comprehensive examination. An example of an acceptable course is the U.S. Department of Transportation's "Safety Inspection of In- Service Bridges."

Certification as a Level IV Bridge Inspector by the National Institute of Certification in Engineering Technologies (NICET) shall also be acceptable [2.2].

For underwater inspections, the registered civil or structural engineer directing the underwater structural inspection shall also be a commercially trained diver or equivalent and shall actively participate in the inspection, by personally conducting a minimum of 25 percent of the underwater examination [2.2].

Each underwater team member shall also be a commercially trained diver, or equivalent. Divers performing manual tasks such as cleaning or supporting the diving operation, but not conducting or reporting on inspections, may have lesser technical qualifications [2.2].

3102F.3.4.4 Structural analyst. *A California registered civil or structural engineer shall be in responsible charge of the structural evaluations.*

3102F.3.4.5 Electrical inspection team. *A registered electrical engineer shall direct the on-site team performing the inspection and evaluation of electrical components and systems.*

3102F.3.4.6 Mechanical inspection team. *A registered engineer shall direct the on-site team performing the inspection and evaluation of piping/pipeline, mechanical and fire components and systems, except the Fire Protection Assessment in accordance with Section 3108F.2.2.*

3102F.3.4.7 Corrosion specialist. *The corrosion specialist shall be a chemical engineer, corrosion engineer, chemist or other professional with expertise in the types and causes of corrosion, and available means to prevent, monitor and mitigate associated damage. The specialist shall perform the corrosion assessment (Section 3102F.3.6.5) and may be directly involved in corrosion inspection (Section 3102F.3.5.4).*

3102F.3.4.8 Geotechnical analyst. *A California registered civil engineer with a California authorization as a geotechnical engineer shall perform the geotechnical evaluation required for the audit and all other geotechnical evaluations.*

3102F.3.4.9 Division representation. *The Division representative(s) may participate in any audit or inspection as observer(s). The Division shall be notified in advance of audit-related inspections.*

3102F.3.5 Scope of inspections.

3102F.3.5.1 Structural inspections.

3102F.3.5.1.1 Above water structural inspection. *The above water inspection shall include all accessible components above and below deck that are reachable without the need for excavation or extensive removal of materials that may impair visual inspection. The above water inspection shall include, but not be limited to, the following:*

1. *Piles*
2. *Pile caps*
3. *Beams*
4. *Deck soffit*
5. *Bracing*
6. *Retaining walls and bulkheads*
7. *Connections*
8. *Seawalls*
9. *Slope protection*
10. *Deck topsides and curbing*
11. *Expansion joints*
12. *Fender system components*
13. *Dolphins and deadmen*
14. *Mooring points and hardware*
15. *Navigation aids*
16. *Platforms, ladders, stairs, handrails and gangways*
17. *Backfill (sinkholes/differential settlement)*

3102F.3.5.1.2 Underwater structural inspection. *The underwater inspection shall include all components below deck to the mudline, including the slope and slope protection, in areas immediately surrounding the MOT. The water depth at the berth(s) shall be evaluated, verifying the maximum or loaded draft specified in the MOT's Operations Manual (2 CCR 2385) [2.1].*

The underwater structural inspection shall include the Level I, II and III inspection efforts, as shown in Tables 31F-2-2 and 31F-2-3. The underwater inspection levels of effort are described below, per [2.2]:

Level I—Includes a close visual examination, or a tactile examination using large sweeping motions of the hands where visibility is limited. Although the Level I effort is often referred to as a "swim-by" inspection, it must be detailed enough to detect obvious major damage or deterioration due to overstress or other severe deterioration. It should confirm the continuity of the full length of all members and detect undermining or exposure of normally buried elements. A Level I effort may also include limited probing of the substructure and adjacent channel bottom.

Level II—A detailed inspection which requires marine growth removal from a representative sampling of components within the structure. For piles, a 12-inch high band shall be cleaned at designated locations, generally near the low waterline, at the mudline,

and midway between the low waterline and the mudline. On a rectangular pile, the marine growth removal should include at least three sides; on an octagon pile, at least six sides; on a round pile, at least three-fourths of the perimeter. On large diameter piles, 3 ft or greater, marine growth removal should be effected on 1 ft by 1 ft areas at four locations approximately equally spaced around the perimeter, at each elevation. On large solid faced elements such as retaining structures, marine growth removal should be effected on 1 ft by 1 ft areas at the three specified elevations. The inspection should also focus on typical areas of weakness, such as attachment points and welds. The Level II effort is intended to detect and identify damaged and deteriorated areas that may be hidden by surface biofouling. The thoroughness of marine growth removal should be governed by what is necessary to discern the condition of the underlying structural material. Removal of all biofouling staining is generally not required.

Level III—A detailed inspection typically involving nondestructive or partially-destructive testing, conducted to detect hidden or interior damage, or to evaluate material homogeneity. Level III testing is generally limited to key structural areas, areas which are suspect or areas which may be representative of the underwater structure.

TABLE 31F-2-2—UNDERWATER INSPECTION LEVELS OF EFFORT [2.2]

LEVEL	PURPOSE	DETECTABLE DEFECTS			
		Steel	Concrete	Timber	Composite
I	General visual/tactile inspection to confirm as-built condition and detect severe damage	Extensive corrosion, holes Severe mechanical damage	Major spalling and cracking Severe reinforcement corrosion Broken piles	Major loss of section Broken piles and bracings Severe abrasion or marine borer attack	Permanent deformation Broken piles Major cracking or mechanical damage
II	To detect surface defects normally obscured by marine growth	Moderate mechanical damage Corrosion pitting and loss of section	Surface cracking and spalling Rust staining Exposed reinforcing steel and/or prestressing strands	External pile damage due to marine borers Splintered piles Loss of bolts and fasteners Rot or insect infestation	Cracking Delamination Material degradation
III	To detect hidden or interior damage, evaluate loss of cross-sectional area or evaluate material homogeneity	Thickness of material Electrical potentials for cathodic protection	Location of reinforcing steel Beginning of corrosion of reinforcing steel Internal voids Change in material strength	Internal damage due to marine borers (internal voids) Decrease in material strength	N/A

TABLE 31F-2-3—SCOPE OF UNDERWATER INSPECTION [2.2]

LEVEL		SAMPLE SIZE AND METHODOLOGY[1]							
		Steel		Concrete		Timber		Composite	Slope Protection, Channel Bottom or Mudline-Scour
		Piles	Bulkheads/ Retaining Walls	Piles	Bulkheads/ Retaining Walls	Piles	Bulkheads/ Retaining Walls	Piles	
I	Sample Size: Method:	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% VisualTactile	100% Visual/Tactile
II	Sample Size: Method:	10% Visual: Removal of marine growth in 3 bands	Every 100 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth in 3 bands	Every 100 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth on 3 bands Measurement: Remaining diameter	Every 50 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth in 3 bands	As necessary
III	Sample Size: Method:	5% Remaining thickness measurement; electrical potential measurement; corrosion profiling as necessary	Every 200 LF Remaining thickness measurement; electrical potential measurement; corrosion profiling as necessary	0% N/A	0% N/A	5% Internal marine borer infestation evaluation	Every 100 LF Internal marine borer infestation evaluation	0%	Sonar imaging as necessary

1. The minimum inspection sampling size for small structures shall include at least two components.

LF = Linear Feet; SF = Square Feet; N/A = Not Applicable

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3102F.3.5.2 Special inspection considerations.

3102F.3.5.2.1 Coated components. *For coated steel components, Level I and Level II efforts should focus on the evaluation of the integrity and effectiveness of the coating. The piles should be inspected without damaging the coating. Level III efforts should include ultrasonic thickness measurements without removal of the coating, where feasible.*

3102F.3.5.2.2 Encased components. *For steel, concrete or timber components that have been encased, the Level I and II efforts should focus on the evaluation of the integrity of the encasement. If evidence of significant damage to the encasement is present, or if evidence of significant deterioration of the underlying component is present, then the damage evaluation should consider whether the encasement was provided for protection and/or structural capacity. Encasements should not typically be removed for an audit.*

For encasements on which the formwork has been left in place, the inspection should focus on the integrity of the encasement, not the formwork. Level I and Level II efforts in such cases should concentrate on the top and bottom of the encasement. For concrete components, if deterioration, loss of bonding or other significant problems with the encasement are suspected, it may be necessary to conduct a special inspection, including coring of the encasement and laboratory evaluation of the materials.

3102F.3.5.2.3 Wrapped components. *For steel, concrete or timber components that have been wrapped, the Level I and II efforts should focus on the evaluation of the integrity of the wrap. Since the effectiveness of a wrap may be compromised by removal, and since the removal and re-installation of wraps is time-consuming, it should not be routinely done. However, if evidence of significant damage exists, or if the effectiveness of the wraps is in question, then samples should be removed to facilitate the inspection and evaluation. The samples may be limited to particular zones or portions of members if damage is suspected, based on the physical evidence of potential problems. A minimum sample size of three members should be used. A five-percent sample size, up to 30 total members, may be adequate as an upper limit.*

For wrapped timber components, Level III efforts should consist of removal of the wraps from a representative sample of components in order to evaluate the condition of the timber beneath the wrap. The sample may be limited to particular zones or portions of the members if damage is suspected (e.g., at the mudline/ bottom of wrap or in the tidal zone). The sample size should be determined based on the physical evidence of potential problems and the aggressiveness of the environment. A minimum sample size of three members should be used. A five-percent sample size, up to 30 total members, may be adequate as an upper limit.

3102F.3.5.3 Mechanical and electrical inspections. *The mechanical and electrical inspections shall include but not be limited to the following:*

1. *Loading arms*
2. *Cranes and lifting equipment, including cables*
3. *Piping/manifolds and supports*
4. *Oil transfer hoses*
5. *Fire detection and suppression systems*
6. *Vapor control system*
7. *Sumps/sump tanks*
8. *Vent systems*
9. *Pumps and pump systems*
10. *Lighting*
11. *Communications equipment*
12. *Gangways*
13. *Electrical switches and junction boxes*
14. *Emergency power equipment*
15. *Air compressors*
16. *Meters*
17. *Cathodic protection systems*
18. *Winches*
19. *ESD and other control systems*
20. *Ladders*

All alarms, limit switches, load cells, current meters, anemometers, leak detection equipment, etc., shall be operated and/or tested to the extent feasible, to ensure proper function.

Utility, auxiliary and fire protection piping shall have external visual inspections, similar to that defined in Section 10.1 of API RP 574 [2.3] (N/E).

3102F.3.5.4 Corrosion inspection. *During each audit, a comprehensive corrosion inspection shall be performed by a qualified engineer or technician. This inspection shall include all steel and metallic components, and any installed cathodic protection system (CPS). CPS inspection during the audit is not intended to substitute for required testing and maintenance performed on a*

more frequent schedule per Section 3111F.10. All inspection results shall be documented, and shall be used in the corrosion assessment (Section 3102F.3.6.5).

Submerged wharf structures and associated cathodic protection equipment (if installed) shall be inspected per [2.2]. Above water structures, ancillary equipment, supports and hardware shall be visually inspected. Corrosion inspection of utility, auxiliary and fire pipelines shall be done per Section 3102F.3.5.3.

For oil pipelines in an API 570 [2.4] inspection program, a corrosion inspection is not required as part of the audit; however, the latest inspection results, calculations and conclusions shall be reviewed, and any significant results shall be included in the corrosion assessment.

3102F.3.6 Evaluation and assessment.

3102F.3.6.1 Terminal operating limits. *The physical boundaries of the facility shall be defined by the berthing system operating limits, along with the vessel size limits and environmental conditions.*

The audit shall include "Terminal Operating Limits" (TOLs) diagrams, which provide a concise statement of the purpose of each berthing system in terms of operating limits for representative vessel size ranges and mooring configurations approved to call and/or conduct transfer operations at the MOT. This description shall include, the minimum and maximum vessel sizes, including Length Overall (LOA), beam and maximum draft with associated displacement (see Figure 31F-2-1).

In establishing limits for both the minimum and maximum vessel sizes, due consideration shall be given to water depths, dolphin spacing, fender system limitations, manifold height and hose/loading arm reach, with allowances for tidal fluctuations, surge and drift.

Maximum wind, current or wave conditions, or combinations thereof, shall be clearly defined as limiting conditions for vessels at each berth, both with and without active product transfer.

The TOLs shall be explicitly presented to facilitate implementation by the MOT operator, such as through incorporation in the MOT's Operations Manual (2 CCR 2385 [2.1]). The TOLs shall allow for direct comparison of operating limits and output from monitoring systems and instrumentation (i.e., anemometers, current meters, tension monitoring systems, velocity monitoring systems). Design and implementation considerations shall include, but not be limited to:

1. *Units of measurement (i.e., English vs. System International units)*
2. *Directionality (i.e., current restrictions "to", wind restrictions "from", true or magnetic north)*
3. *Parameters of monitoring systems and instrumentation (i.e., duration/averaging of readings, elevation/depth of readings, distance/location of readings)*

3102F.3.6.2 Mooring and berthing. *Mooring and berthing analyses shall be performed in accordance with Section 3105F. The analyses shall be consistent with the terminal operating limits and the structural configuration of the wharf and/or dolphins and associated hardware.*

Based on inspection results, analyses and engineering judgment, mooring and berthing OSARs shall be assigned on a global basis, independently for each structure and overall berthing system. The OSARs defined in Table 31F-2-4 shall be used for this purpose. The mooring and berthing OSARs document the berthing system(s) fitness-for-purpose.

3102F.3.6.3 Structure. *A structural evaluation, including a seismic analysis, shall be performed in accordance with Sections 3103F through 3107F. Such evaluation shall consider local or global reduction in capacity, as determined from the inspection.*

Based on inspection results, structural analyses and engineering judgment, OSARs (for operational loading) and SSARs shall be assigned on a global basis, independently for each structure, structural system(s) and berthing system(s), as appropriate. The OSARs and SSARs defined in Table 31F-2-4 shall be used for this purpose and document the structural and/or berthing system(s) fitness-for-purpose.

Based on inspection results and engineering judgment, ICARs shall be assigned on a global basis, independently for each above and underwater structure, structural system and berthing system, as appropriate. The ICARs defined in Table 31F-2-4 shall be used for this purpose.

Structural component deficiencies assigned RAPs as per Table 31F-2-5 shall be considered in the OSARs, SSARs and ICARs. The assigned ratings shall remain in effect until all the significant corrective action has been completed to the satisfaction of the Division, or until completion of the next audit.

TABLE 31F-2-4—ASSESSMENT RATINGS			
RATING		DESCRIPTION OF STRUCTURE(S) AND/OR SYSTEMS[4]	
		OSAR[1] and SSAR[2]	ICAR[3]
6	Good	The capacity of the structure or system meets the requirements of this standard. The structure or system should be considered fit-for-purpose. No repairs or upgrades are required.	No problems or only minor problems noted. Structural elements may show very minor deterioration, but no overstressing observed. No repairs or upgrades are required.
5	Satisfactory	The capacity of the structure or system meets the requirements of this standard. The structure or system should be considered fit-for-purpose. No repairs or upgrades are required.	Limited minor to moderate defects or deterioration observed, but no overstressing observed. No repairs or upgrades are required.
4	Fair	The capacity of the structure or system is no more than 15 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system should be considered as marginal. Repair and/or upgrade measures may be required to remain operational. Facility may remain operational, provided a plan and schedule for remedial action is presented to and accepted by the Division.	All primary structural elements are sound, but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present, but do not significantly reduce the load bearing capacity of the structure. Repair and/or upgrade measures may be required to remain operational. Facility may remain operational, provided a plan and schedule for remedial action is presented to and accepted by the Division.
3	Poor	The capacity of the structure or system is no more than 25 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system is not fit-for-purpose. Repair and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted or contingency basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.	Advanced deterioration or overstressing observed on widespread portions of the structure, but does not significantly reduce the load bearing capacity of the structure. Repair and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted or contingency basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.
2	Serious	The capacity of the structure or system is more than 25 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system is not fit-for-purpose. Repairs and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.	Advanced deterioration, overstressing or breakage may have significantly affected the load bearing capacity of primary structural components. Local failures are possible and loading restrictions may be necessary. Repairs and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.
1	Critical	The capacity of the structure or system is critically deficient relative to the requirements of this standard. The structure or system is not fit-for-purpose. The facility shall cease operations until deficiencies are corrected and accepted by the Division.	Very advanced deterioration, overstressing or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur and load restrictions should be implemented as necessary. The facility shall cease operations until deficiencies are corrected and accepted by the Division.

1. OSAR = Operational Structural Assessment Ratings
2. SSAR = Seismic Structural Assessment Ratings
3. ICAR = Inspection Condition Assessment Ratings [2.2]; Ratings shall be assigned comparing the observed condition to the as-built condition.
4. Structural, mooring or berthing systems

TABLE 31F-2-5—COMPONENT DEFICIENCY REMEDIAL ACTION PRIORITIES (RAP)	
REMEDIAL PRIORITIES	DESCRIPTION AND REMEDIAL ACTIONS
P1	Specified whenever a condition that poses an immediate threat to public health, safety or the environment is observed. Emergency Actions may consist of barricading or closing all or portions of the berthing system, evacuating product lines and ceasing transfer operations. The berthing system is not fit-for-purpose. Immediate remedial actions are required prior to the continuance of normal operations.
P2	Specified whenever defects or deficiencies pose a potential threat to public health, safety and the environment. Actions may consist of limiting or restricting operations until remedial measures have been completed. The berthing system is not fit-for-purpose. This priority requires investigation, evaluation and urgent action.
P3	Specified whenever systems require upgrading in order to comply with the requirement of these standards or current applicable codes. These deficiencies do not require emergency or urgent actions. The MOT may have limitations placed on its operational status.
P4	Specified whenever damage or defects requiring repair are observed. The berthing system is fit-for-purpose. Repair can be performed during normal maintenance cycles, but not to exceed one year.
R	Recommended action is a good engineering/maintenance practice, but not required by these standards. The berthing system is fit-for-purpose.

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3102F.3.6.4 Mechanical and electrical systems. *An evaluation of all mechanical and electrical systems and components shall be performed in accordance with Sections 3108F through 3111F of these standards. Forces and imposed seismic displacements resulting from the structural analysis shall be considered in the pipeline stress analyses (Section 3109F.3), and the piping/pipelines shall be assigned SSARs in Table 31F-2-7B. Mechanical and electrical component deficiencies shall be assigned ratings from Table 31F-2-5.*

3102F.3.6.5 Corrosion assessment (N/E). *A comprehensive assessment shall be performed by the corrosion specialist (Section 3102F.3.4.7), to determine the existing and potential corrosion using "as-built" drawings and specifications. This assessment shall comprise all steel and metallic components, including the structure, pipelines, supports and other MOT ancillary equipment. This assessment shall also include prestressed and reinforced concrete structures.*

If cathodic protection is installed to protect wharf structures and/or pipelines, the following records shall be evaluated for each system:

1. *CPS equipment condition and maintenance*
2. *Impressed current readings (as applicable)*
3. *Potential survey results*

3102F.3.7 Follow-up actions. *Follow-up actions per Table 31F-2-6 shall be prescribed by the audit team. Multiple follow-up actions may be assigned; however, guidance shall be provided as to the order in which the follow-up actions should be carried out.*

If an assessment rating of "1", "2" or "3" (Table 31F-2-4) or a RAP of "P1" or "P2" (Table 31F-2-5) or "Emergency Action" using Table 31F-2-6, is assigned to a structure, berthing system or critical component, the Division shall be notified immediately. The Executive Summary Table ES-2 (see Example Table 31F-2-8) shall include implementation schedules for all follow-up and remedial actions. Follow-up and remedial actions and implementation schedules are subject to Division approval.

For action plan implementation between audits, see Section 3102F.3.9.

3102F.3.8 Documentation and reporting. *The audit reports shall be signed and stamped by the audit team leader. The inspection and other reports and drawings shall be signed and stamped by the engineers in responsible charge.*

Each audit and inspection, whether partial or complete, shall be adequately documented. Partial inspections cover only specific systems or equipment examined. The resulting reports shall summarize and reference relevant previous ratings and deficiencies. Inspection reports shall be included in subsequent audits.

The contents of the audit and inspection reports for each berthing system shall, at a minimum, include the following as appropriate:

Executive summary—*a concise narrative of the audit or inspection results and analyses conclusions. It shall include summary information for each berthing system, including an overview of the assigned follow-up actions. The Executive Summary Tables shall also be included (see Example Tables 31F-2-7A through 31F-2-7C and 31F-2-8).*

Table of contents

Introduction—*a brief description of the purpose and scope of the audit or inspection, as well as a description of the inspection/evaluation methodology used.*

Existing conditions—*a description, along with a summary, of the observed conditions. Subsections shall be used to describe the above water structure, underwater structure, fire, piping/pipeline, mechanical and electrical systems, to the extent each are included in the scope of the audit. Photos, plan views and sketches shall be utilized as appropriate to describe the structure and the observed conditions. Details of the inspection results such as test data, measurements data, etc., shall be documented in an appendix.*

Evaluation and assessment—*assessment ratings shall be assigned to all structures and/or berthing systems. Also, see Section 3102F.3.6. All supporting calculations, as-built drawings and documentation shall be included in appendices as appropriate to substantiate the ratings. However, the results and recommendations of the engineering analyses shall be included in this section. Component deficiencies shall be described and a corresponding RAP assigned.*

Follow-up actions—*Specific follow-up actions (Table 31F-2-6) shall be documented (Table 31F-2-8), and remedial schedules included, for each audited system. Audit team leaders shall specify which follow-up actions require a California registered engineer to certify that the completion is acceptable.*

Appendices—*When appropriate, the following appendices shall be included:*

1. *Background data on the terminal - description of the service environment (wind/waves/currents), extent and type of marine growth, unusual environmental conditions, etc.*
2. *Inspection/testing data*
3. *Mooring and berthing analyses*
4. *Structural and seismic analyses and calculations*
5. *Geotechnical report*
6. *MOT Fire Protection Assessment*
7. *Pipeline stress and displacement analyses*
8. *Mechanical and electrical system documentation*
9. *Corrosion assessment*
10. *Photographs, sketches and supporting data shall be included to document typical conditions and referenced deficiencies, and to justify the assessment ratings and the remedial action priorities RAPs assigned.*

TABLE 31F-2-6—FOLLOW-UP ACTIONS [2.2]	
FOLLOW-UP ACTION	**DESCRIPTION**
Emergency Action	*Specified whenever a condition which poses an immediate threat to public health, safety or the environment is observed. Emergency Actions may consist of barricading or closing all or portions of the berthing system, limiting vessel size, placing load restrictions, evacuating product lines, ceasing transfer operations, etc.*
Engineering Evaluation	*Specified whenever damage or deficiencies are observed which require further investigation or evaluation to determine appropriate follow-up actions.*
Repair Design Inspection	*Specified whenever damage or defects requiring repair are observed. The repair design inspection is performed to the level of detail necessary to prepare appropriate repair plans, specifications and estimates.*
Upgrade Design and Implementation	*Specified whenever the system requires upgrading in order to comply with the requirements of these standards and current applicable codes.*
Special Inspection	*Typically specified to determine the cause or significance of nontypical deterioration, usually prior to designing repairs. Special testing, laboratory analysis, monitoring or investigation using nonstandard equipment or techniques are typically required.*
Develop and Implement Repair Plans	*Specified when the Repair Design Inspection and required Special Inspections have been completed. Indicates that the structure is ready to have repair plans prepared and implemented.*
No Action	*Specified when no further action is necessary until the next scheduled audit or inspection.*

TABLE 31F-2—7A

EXAMPLE	**EXECUTIVE SUMMARY TABLE (ES-1A) GLOBAL OPERATIONAL STRUCTURAL ASSESSMENT RATINGS (OSAR)**									**REV. # MM/YYYY**
Berthing system	**Berth(s)[1]**	**Structure(s)[1]**	**Type of analysis[2]**	**OSAR rating[4]**	**Last audit date (MM/YYYY)**	**Next audit due date (MM/YYYY)**	**Last analysis date (MM/YYYY)[5]**	**Repair/ replacement due date (MM/YYYY)[6]**	**Fit-for-purpose (Y/N)**	**Description or comments[7]**
North Wharf	*Berth 1*	*Wharfhead*	*O*	*5*	*08/2008*	*08/2011*	*02/2008*	*N/A*	*Y*	*None*
North Wharf	*Berth 1*	*Mooring Dolphin*	*M*	*3*	*08/2008*	*08/2011*	*05/2008*	*12/2008*	*N*	*Hook capacity inadequate*
North Wharf	*Berth 1*	*Breasting Dolphin*	*B*	*2*	*08/2008*	*08/2011*	*06/2008*	*02/2010*	*N*	*Berthing velocity restrictions required. Velocity monitoring system operational. Fender system to be upgraded. See Terminal Operating Limits.*
North Wharf	*Berth 1*	*Overall*	*O*	*4*	*08/2008*	*08/2011*	*02/2008*	*N/A*	*Y*	*None*
North Wharf	*Berth 1*	*Dolphins, Trestles, Catwalks, Bulkhead walls, etc.*			*08/2008*	*08/2011*				
South Wharf	*Berth 2*				*08/2008*	*08/2011*				

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TABLE 31F-2—7B

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1B) GLOBAL SEISMIC STRUCTURAL ASSESSMENT RATINGS (SSAR)								REV. # MM/YYYY
Berthing system	Berth(s)[1]	Structure(s)[1]	SSAR rating[4]	Last audit date (MM/YYYY)	Next audit due date (MM/YYYY)	Last analysis date (MM/YYYY)[5]	Repair/ replacement due date (MM/YYYY)[6]	Fit-for-purpose (Y/N)	Description or comments[7]
North Wharf	Berth 1	Wharfhead	2	08/2008	08/2011	05/2008	02/2010	N	Level 1 – OK; SAP2000 Pushover Analysis Level 2 – NG; SAP2000 Pushover Analysis displacements too large and liquefaction
North Wharf	Berth 1	Trestle	5	08/2008	08/2011	05/2008	N/A	Y	Level 1 – OK; SAP2000 Linear Analysis Level 2 – OK; SAP2000 Linear Analysis
North Wharf	Berth 1	30" Crude line	5	08/2008	08/2011	05/2008	N/A	Y	Level 1 – N/A Level 2 – OK; CAESAR Analysis
North Wharf	Overall	Overall							
North Wharf	Berth 1	Dolphins, Pipeline, Trestles, Bulkhead walls, etc.							
South Wharf	Berth 2								

TABLE 31F-2-7C

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1C) GLOBAL INSPECTION CONDITION ASSESSMENT RATINGS (ICAR)[8]							REV. # MM/YYYY
Berthing system	Berth(s)[1]	Structure(s)[1]	Type of inspection[3]	ICAR rating[4,9]	Last inspection date (MM/YYYY)[10]	Inspection interval (YRS.)	Next inspection due date (MM/YYYY)[10]	Description or comments[7]
North Wharf	Berth 1	Wharfhead	AW	5	02/2008	3	02/2011	General satisfactory condition. See RAPs in Table ES-2 for details.
North Wharf	Berth 1	Wharfhead	UW	4	02/2008	5	02/2013	Pile damage; 10 serve, 15 minor See RAPs in Table ES-2 for details.
North Wharf	Berth 1	Breasting Dolphin BD-1	AW	6	02/2008	3	02/2011	See RAPs in Table ES-2
North Wharf	Berth 1	Breasting Dolphin BD-1	UW	5	02/2008	5	02/2013	See RAPs in Table ES-2
North Wharf	Berth 1	Dolphins, Trestle, Catwalks, Bulkhead walls, etc.						
South Wharf	Berth 2							

These notes apply to Tables 31F-2-7A through 7C:

1. *The term "Overall" shall be input in this field when the assessment ratings are summarized for a berth.*
2. *"Types of Analyses": "O" = Operational Loading Analysis, "M" = Mooring Analysis, "B" = Berthing Analysis*
3. *"Types of Inspections": "AW" = Above Water Inspection, "UW" = Underwater Inspection*
4. *All assessment ratings shall be assigned in accordance with Table 31F-2-4.*
5. *The "Analysis Dates" are defined by the month and year in which the final design package is submitted to the Division.*
6. *The "Repair/Replacement Dates" are defined by the month and year in which the repair/replacement is to be completed and operational.*
7. *The "Description or Comments" shall reference all MOT operating limits. For OSARs, this includes berthing velocity restrictions, load limits, etc. For SSARs, this includes a brief list of the findings for each Seismic Performance Level.*
8. *Inspection findings may trigger a structural reassessment (see Tables 31F-2-7A and 31F-2-7B).*
9. *Ratings shall be assigned comparing the observed condition to the as-built condition.*
10. *The "Inspection Dates" are defined by the month and year in which the last day of formal field inspection is conducted.*

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TABLE 31F-2-8

EXAMPLE		EXECUTIVE SUMMARY TABLE (ES-2) COMPONENT DEFICIENCY REMEDIAL ACTION PRIORITIES (RAP)[1]									REV. # MM/YYYY
Berthing system	Berth(s)	Structure(s) or location(s)	Deficiency item label[2]	Component: deficiency description	Remedial action priority (RAP)[3]	CBC section reference	Audit checklist reference (optional)	Description of planned remedial action	P.E. review required? (Y/N)[4]	Repair/ replacement due date (MM/YYYY)	Completion date (MM/YYYY)	Description of completed actions
North Wharf	Berth 1	Wharfhead	02.0001.001	**Piles:** 10 piles have severe damage; 15 piles have minor damage.	P2	3102F.3.5.2		Replace 10 severe piles. Monitor 15 minor piles.	Y	05/2008	04/2008	10 piles replaced
North Wharf	Berth 1	Mooring Dolphin MD-1	02.0001.002	**Curb:** Spalling of concrete curb w/o exposed reinforcement	R	3102F.3.5.2		Repair concrete curbs.	N	02/2009		
North Wharf	Berth 1	Wharfhead	08.0001.002	**International Shore Fire Connection:** Connections available, but not connected.	P3	3108F.6.3.4	8.6.22	Install International Shore Fire Connections.	N	10/2008		
North Wharf	Berth 1	Wharfhead	11.0001.001	**Conduit Seals near Manifold:** Conduit seals inadequate for Class 1, Division 1 location.	P1	3111F.2		Replace conduit seals with seals adequate for Class 1. Division 1 location within 30 days.	Y	04/2008	04/2008	Seals replaced
North Wharf	Berth 1	Wharfhead	11.0001.001	**Pressurized Instrumentation Panel near Shelter:** Pressure gauge reads "low" and will not hold pressure in Class 1, Division 2 location.	P2	3111F.2	3111F.4.5	Repair pressurized instrumentation panel in Class 1, Division 2 Location within 60 days.	Y	05/2008	05/2008	Pressurized instrumentation panel could not be repaired and was replaced.

These notes apply to Table 31F-2-8:

1. *After a deficiency is corrected/completed, the row of text corresponding to that deficiency may be grayed out in subsequent ES-2 tables, and removed entirely in the subsequent audit.*
2. *The "Deficiency Item Labels" shall be assigned in the format shown above with the first series of numbers representing the Code Division/Section number ("XX"), a period (".") for separation, the second series of numbers representing the deficiency item number ("XXXX"), a period (".") for separation, and the third series of numbers representing the ES-2 table revision number ("XXX") in which the deficiency was first reported. Note that the deficiency item numbering will start from "0001" for the first deficiency in each section of the audit, and will increase consecutively in all future ES-2 tables.*
3. *RAPs shall be assigned in accordance with Table 31F-2-5.*
4. *Professional engineering review required in accordance with Section 3102F.3.8 under "Follow-up Actions."*

3102F.3.9 Action plan implementation between audits. *The operator is responsible for correction of deficiencies between audits. Prior to implementation, projects shall be submitted for Division review in accordance with Section 3101F.8.3. During project implementation, the Division shall be informed of any significant changes. After project completion, "as-built" documentation, including drawings, calculations and analyses, shall be submitted to the Division.*

Executive Summary Tables shall be updated by the operator and submitted to the Division at least annually.

3102F.4 Post-event notification and inspection. *A post-event inspection is a focused inspection following a significant, potentially damage-causing event such as an earthquake, storm, vessel impact, fire, explosion, construction incident or tsunami. The primary purpose is to assess the integrity of structural, mechanical and electrical systems. This assessment will determine the operational status and/or any remedial measures required.*

3102F.4.1 Notification and action plan. *Notification as per 2 CCR 2325(e) [2.1] shall be provided to the local area Division field office. The notification shall include, as a minimum:*

1. *Brief description of the event*
2. *Brief description of the nature, extent and significance of any damage observed as a result of the event*
3. *Operational status and any required restrictions*
4. *Statement as to whether a post-event inspection will be carried out*

The Division may carry out or cause to be carried out, a post-event inspection. In the interim, the Division may direct a change in the operations manual, per 2 CCR 2385 (f)(3) [2.1].

If a post-event inspection is required, an action plan shall be submitted to the Division within five (5) days after the event. This deadline may be extended in special circumstances. The action plan shall include the scope of the inspection (above water, underwater, electrical, mechanical systems, physical limits, applicable berthing systems, etc.) and submission date of the final report. The action plan is subject to Division approval.

3102F.4.2 Inspection team. *The qualifications of the inspection team shall be the same as those prescribed in Section 3102F.3.4. Division representatives may participate in any post-event inspection, as observers, and may provide guidance.*

3102F.4.3 Scope. *The post-event inspection shall focus on the possible damage caused by the event. General observations of long-term or preexisting deterioration such as significant corrosion-related damage or other deterioration should be made as appropriate, but should not be the focus of the inspection. The inspection shall always include an above-water assessment of structural, mechanical and electrical components.*

The inspection team leader shall determine the need for, and methodology of, an underwater structural assessment, in consultation with the Division. Above water observations, such as shifting or differential settlement, misalignments, significant cracking or spalling, bulging, etc., shall be used to determine whether or not an underwater assessment is required. Similarly, the inspection team leader shall determine, in consultation with the Division, the need for, and methodology of, any supplemental inspections (e.g., special inspections (see Section 3102F.3.5.3).

The following information may be important in determining the need for, and methodology of, the post-event inspection:

1. *Earthquakes or vessel or debris impact typically cause damage both above and below the waterline. Following a major earthquake, the inspection should focus on components likely to attract highest lateral loads (batter or shorter piles in the rear of the structure, etc.). In case of vessel or debris impact, the inspection effort should focus on components in the path of the impact mass.*
2. *Major floods or tsunamis may cause undermining of the structure and/or scouring at the mudline.*
3. *Fire damage varies significantly with the type of construction materials but all types may be adversely affected. Special inspections (sampling and laboratory testing) shall be conducted, as determined by the inspection team leader, in order to determine the nature and extent of damage.*
4. *High wind or wave events often cause damage both above and below the waterline. An underwater inspection may be required if damage is visible above the waterline. Structural damage may be potentially increased if a vessel was at the berth during the event. The effects of high wind may be most prevalent on equipment and connections of such equipment to the structure.*

The methodology of conducting an underwater post- event inspection should be established with due consideration of the structure type and type of damage anticipated. Whereas slope failures or scour may be readily apparent in waters of adequate visibility, overstressing cracks on piles covered with marine growth will not be readily apparent. Where such hidden damage is suspected, marine growth removal should be performed on a representative sampling of components in accordance with the Level II effort requirements described in Section 3102F.3.5.2. The cause of the event will determine the appropriate sample size and locations.

3102F.4.4 Post-event ratings. *A post-event rating [2.2] shall be assigned to each berthing system upon completion of the inspection (see Table 31F-2-9). All observations of the above and under water structure, mechanical and electrical components and systems shall be considered in assigning a post-event rating.*

Ratings should consider only damage that was likely caused by the event. Pre-existing deterioration such as corrosion damage should not be considered unless the structural integrity is immediately threatened or safety systems or protection of the environment may be compromised.

Assignment of ratings should reflect an overall characterization of the berthing system being rated. The rating shall consider both the severity of the deterioration and the extent to which it is widespread throughout the facility. The fact that the facility was designed for loads that are lower than the current standards for design should have no influence upon the ratings.

TABLE 31F-2-9—POST-EVENT RATINGS AND REMEDIAL ACTIONS [2.2]

RATING	SUMMARY OF DAMAGE	REMEDIAL ACTIONS
A	*No significant event-induced damage observed.*	*No further action required. The berthing system may continue operations.*
B	*Minor to moderate event-induced damage observed but all primary structural elements and electrical/mechanical systems are sound.*	*Repairs or mitigation may be required to remain operational. The berthing system may continue operations.*
C	*Moderate to major event-induced damage observed which may have significantly affected the load bearing capacity of primary structural elements or the functionality of key electrical/mechanical systems.*	*Repairs or mitigation may be necessary to resume or remain operational. The berthing system may be allowed to resume limited operations.*
D	*Major event-induced damage has resulted in localized or widespread failure of primary structural components; or the functionality of key electrical/ mechanical systems has been significantly affected. Additional failures are possible or likely to occur.*	*The berthing system may not resume operations until the deficiencies are corrected.*

3102F.4.5 Follow-up actions. *Follow-up actions shall be assigned upon completion of the post-event inspection of each berthing system. Table 31F-2-5 specifies remedial action priorities for deficiencies. Table 31F-2-6 specifies various follow-up actions. Multiple follow-up actions may be assigned; however, guidance should be provided as to the order in which the follow-up actions should be carried out. Follow-up actions shall be subject to Division approval.*

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3102F.4.6 Documentation and reporting. *Documentation of the specific attributes of each defect shall not be required during a post-event inspection. However, a narrative description of significant damage shall be used. The description shall be consistent with and shall justify the post-event rating assigned.*

A report shall be prepared and submitted to the Division upon completion of the post-event inspection and shall, at a minimum, include:

1. *Brief description of the facility including the physical limits of the structure, type of construction material(s), and the mechanical and electrical systems present*
2. *Brief description of the event triggering the inspection*
3. *Scope of the inspection (above water, underwater, electrical or mechanical)*
4. *Date of the inspection*
5. *Names and affiliations of inspection team*
6. *Description of the nature, extent and significance of any observed damage resulting from the event*
7. *Photographs should be provided to substantiate the descriptions and justify the condition rating*
8. *Assignment of a post-event rating*
9. *Statement regarding whether the facility is fit to resume operations and, if so, under what conditions*
10. *Assignment of follow-up action(s)*
11. *Inspection data, drawings, calculations and other relevant engineering materials*
12. *Signature and stamp of team leader(s)*

3102F.4.7 Action Plan Report. *Upon completion of all actions delineated in the action plan, a final report shall be submitted to the Division to document the work completed. Supporting documentation such as calculations or other relevant data shall be provided in appendices.*

3102F.5 References.

[2.1] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)

[2.2] Childs, K.M., editor, 2001, "Underwater Investigations - Standard Practice Manual," American Society of Civil Engineers, Reston, VA.

[2.3] American Petroleum Institute (API), 2009, API Recommended Practice 574 (API RP 574), "Inspection Practices for Piping System Components," 3rd ed., Washington, D.C.

[2.4] American Petroleum Institute (API), 2009, API 570, "Piping Inspection Code: In-service Inspection, Rating, Repair, and Alteration of Piping Systems," 3rd ed., Washington, D.C.

Authority: *Sections 8750 through 8760, Public Resources Code*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

DIVISION 3

SECTION 3103F—STRUCTURAL LOADING CRITERIA

3103F.1 General. *Section 3103F establishes the environmental and operating loads acting on the marine oil terminal (MOT) structures and on moored vessel(s). The analysis procedures are presented in Sections 3104F – 3107F.*

3103F.2 Dead loads.

3103F.2.1 General. *Dead loads shall include the weight of the entire structure, including permanent attachments such as loading arms, pipelines, deck crane, fire monitor tower, gangway structure, vapor control equipment and mooring hardware. Unit weights specified in Section 3103F.2.2 may be used for MOT structures if actual weights are not available.*

3103F.2.2 Unit weights. *The unit weights in Table 31F-3-1 may be used for both existing and new MOTs.*

TABLE 31F-3-1—UNIT WEIGHTS

MATERIAL	*UNIT WEIGHT (pcf)**
Steel or cast steel	*490*
Cast iron	*450*
Aluminum alloys	*175*
Timber (untreated)	*40-50*
Timber (treated)	*45-60*
Concrete, reinforced (normal weight)	*145-160*
Concrete, reinforced (lightweight)	*90-120*
Asphalt paving	*150*

** pounds per cubic foot*

3103F.2.3 Equipment and piping area loads. *The equipment and piping area loads in Table 31F-3-2 may be used, as a minimum, in lieu of detailed as-built data.*

TABLE 31F-3-2—EQUIPMENT AND PIPING AREA LOADS

LOCATION	*AREA LOADS (psf)****
Open areas	*20**
Areas containing equipment and piping	*35***
Trestle roadway	*20**

** Allowance for incidental items such as railings, lighting, miscellaneous equipment, etc.*

***35 psf is for miscellaneous general items such as walkways, pipe supports, lighting and instrumentation. Major equipment weight shall be established and added into this weight for piping manifold, valves, deck crane, fire monitor tower, gangway structure and similar ma/or equipment.*

**** pounds per square foot*

3103F.3 Live loads and buoyancy. *The following vertical live loading shall be considered, where appropriate: uniform loading, truck loading, crane loading and buoyancy. Additionally, MOT specific, nonpermanent equipment shall be identified and used in loading computations.*

3103F.4 Earthquake loads.

3103F.4.1 General. *Earthquake loads are described in terms of Peak Ground Acceleration (PGA), spectral acceleration and earthquake magnitude. The required seismic analysis procedures (Tables 31F-4-1 and 31F-4-2) are dependent on the spill classification obtained from Table 31F-1-1.*

3103F.4.2 Design earthquake motion parameters. *The earthquake ground motion parameters of peak ground acceleration, spectral acceleration and earthquake magnitude are modified for site amplification and near fault directivity effects. The resulting values are the Design Peak Ground Acceleration (DPGA), Design Spectral Acceleration (DSA) and Design Earthquake Magnitude (DEM).*

For Site Classes A through E (Section 3103F.4.2.1), peak ground and design spectral accelerations shall be obtained from:

1. *U.S. Geological Survey (USGS) published data as discussed in Section 3103F.4.2.2, or*
2. *A site-specific probabilistic seismic hazard analysis (PSHA) as discussed in Section 3103F.4.2.3.*

Site-specific PSHA is required for Site Class F.

Unless stated otherwise, the DSA values are for 5 percent damping; values at other levels may be obtained as per Section 3103F.4.2.9.

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The appropriate probability levels associated with DPGA and DSA for different seismic performance levels are provided in Table 31F-4-1. Deterministic earthquake motions, which are used only for comparison to the probabilistic results, are addressed in Section 3103F.4.2.7.

The evaluation of Design Earthquake Magnitude (DEM), is discussed in Section 3103F.4.2.8. This parameter is required when acceleration time histories (Section 3103F.4.2.10) are addressed or if liquefaction potential (Section 3106F.4) is being evaluated.

3103F.4.2.1 Site classes. *The following Site Classes, defined in Section 3106F.2.1, shall be used in developing values of DSA and DPGA:*

A, B, C, D, E and F

For Site Class F, a site-specific response analysis is required per Section 3103F.4.2.5.

3103F.4.2.2 Earthquake motions from USGS maps. *Earthquake ground motion parameters can be obtained directly from the US Seismic Design Maps tool available at the USGS website (http://earthquake.usgs.gov) for the site condition(s) appropriate for the MOT site and the selected probability of exceedance. For this purpose, select the ASCE/SEI 41 [3.1] as the design code reference document, and specify the appropriate custom parameters, including but not limited to, location, required Probability of Exceedance (in 50 years), and appropriate Site Soil Classification(s) for the MOT site. The USGS tool directly provides the peak ground and spectral accelerations for the selected hazard level and site condition(s).*

The alternative method of obtaining earthquake ground motion parameters, from the most current USGS data for selected hazard level and site condition(s), is permitted. If needed, the data for appropriate probability of exceedance may be obtained using the procedure described in Chapter 1 of FEMA 356 [3.2], and corrected for the MOT site as discussed in Section 3103F.4.2.4 or Section 3103F.4.2.5.

3103F.4.2.3 Earthquake motions from site-specific probabilistic seismic hazard analyses. *Site-specific Probabilistic Seismic Hazard Analysis (PSHA) shall use appropriate seismic sources and their characterization, attenuation relationships, probability of exceedance and site soil conditions. Site-specific PSHA shall be conducted by a qualified California registered civil engineer with a California authorization as a geotechnical engineer per Section 3102F.3.4.8.*

If site-specific PSHA is used for Site Classes A, B, C, D or E, results from the site-specific PSHA shall be compared with those from the USGS published data as described in Section 3103F.4.2.2. If the two sets of values differ significantly, a justification for using the characterization chosen shall be provided. If DPGA and DSA from site-specific PSHA are less than 80 percent of the values from USGS data, a peer review may be required.

3103F.4.2.4 Simplified evaluation of site amplification effects. *When the MOT site class is different from the Site Classes B to C boundary, site amplification effects shall be incorporated in peak ground accelerations and spectral accelerations. This may be accomplished using a simplified method or a site-specific evaluation (Section 3103F.4.2.5).*

For a given site class, the following procedure from Chapter 1 of FEMA 356 [3.2] presents a simplified method that may be used to incorporate the site amplification effects for peak ground acceleration and spectral acceleration computed for the Site Classes B and C boundary.

1. *Calculate the spectral acceleration values at 0.20 and 1.0 second period:*

   Equation 3-1 $S_{XS} = F_a S_S$

   Equation 3-2 $S_{X1} = F_v S_1$

   where:

   F_a *= site coefficient obtained from Table 31F-3-3*

   F_v *= site coefficient obtained from Table 31F-3-4*

   S_S *= short period (usually at 0.20 seconds) spectral acceleration value (for the boundary of Site Classes B and C) obtained using Section 3103F.4.2.2, or at the period corresponding to the peak in spectral acceleration values when obtained from Section 3103F.4.2.3*

   S_1 *= spectral acceleration value (for the boundary of Site Classes B and C) at 1.0 second period*

   S_{XS} *= spectral acceleration value obtained using the short period* S_s *and factored by Table 31F-3-3 for the site class under consideration.*

   S_{X1} *= spectral acceleration value obtained using the 1.0 second period* S_1 *and factored by Table 31F-3-4 for the site class under consideration.*

2. *Set*

   Equation 3-3 $PGA_X = 0.4S_{XS}$

   where:

   PGA_X *= peak ground acceleration corresponding to the site class under consideration.*

   When the value of PGA_X *is less than the peak ground acceleration obtained following Section 3103F.4.2.2 or Section 3103F.4.2.3, an explanation of the results shall be provided.*

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3. *PGA_X, S_{XS} and S_{X1} constitute three spectral acceleration values for the site class under consideration corresponding to periods of 0, S_S (usually 0.2 seconds), and 1.0 second, respectively.*
4. *The final response spectra, without consideration for near-fault directivity effects, values of S_a for the site class under consideration may be obtained using the following equations (for 5 percent critical damping):*

For $0 < T < 0.2T_0$

Equation 3-4 $S_a = (S_{XS})(0.4 + 3T/T_0)$

where:

T = Period corresponding to calculated S_a

T_0 = Period at which the constant acceleration and constant velocity regions of the design spectrum intersect

For $0.2T_0 < T < T_0$

Equation 3-5 $S_a = S_{XS}$

For $T > T_0$

Equation 3-6 $S_a = S_{X1}/T$

where:

Equation 3-7 $T_0 = S_{X1}/S_{XS}$

The resulting PGA_X is the DPGA. However, the S_a shall be modified for near-fault directivity effects, per Section 3103F.4.2.6 to obtain the final DSAs.

TABLE 31F-3-3—VALUES OF F_a

SITE CLASS	S_S				
	< 0.25	0.5	0.75	1.0	> 1.25
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	*	*	*	*	*

Note: *Linear interpolation can he used to estimate values of F_a for intermediate values of S_S.*
** Site-specific dynamic site response analysis shall be performed.*

TABLE 31F-3-4—VALUES OF F_v

SITE CLASS	S_1				
	< 0.1	0.2	0.3	0.4	> 0.5
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	*	*	*	*	*

Note: *Linear interpolation can he used to estimate values of F_v for intermediate values of S_1.*
** Site-specific dynamic site response analysis shall be performed.*

3103F.4.2.5 Site-specific evaluation of amplification effects. *As an alternative to the procedure presented in Section 3103F.4.2.4, a site-specific response analysis may be performed. <u>For Site Class F a site-specific response analysis is required.</u> The analysis shall be either an equivalent linear or nonlinear analysis. Appropriate acceleration time histories as discussed in Section 3103F.4.2.10 shall be used.*

In general, an equivalent linear analysis using, for example, SHAKE91 [3.3] is acceptable when the strength and stiffness of soils are unlikely to change significantly during the seismic shaking and the level of shaking is not large. A nonlinear analysis should be used when the strength and/or stiffness of soils could significantly change during the seismic shaking or significant nonlinearity of soils is expected because of high seismic shaking levels.

The choice of the method used in site response analysis shall be justified considering the expected stress-strain behavior of soils under the shaking level considered in the analysis.

Site-specific site response analysis may be performed using one-dimensional analysis. However, to the extent that MOTs often involve slopes or earth retaining structures, the one-dimensional analysis should be used judiciously. When one-dimensional analysis cannot be justified or is not adequate, two-dimensional equivalent linear or nonlinear response analysis shall be performed. Site-specific response analysis results shall be compared to those based on the simplified method of Section 3103F.4.2.4 for reasonableness.

The peak ground accelerations obtained from this site-specific evaluation are DPGAs and the spectral accelerations are DSAs as long as the near-fault directivity effects addressed in Section 3103F.4.2.6 are appropriately incorporated into the time histories (Section 3103F.4.2.10).

3103F.4.2.6 Directivity effects. *When the site is 15 km (9.3 miles) or closer to a seismic source that can significantly affect the site, near-fault directivity effects shall be reflected in the spectral acceleration values and in the deterministic spectral acceleration values of Section 3103F.4.2.7.*

Two methods are available for incorporating directivity effects:

1. *Directivity effects may be reflected in the spectral acceleration values in a deterministic manner by using well established procedures such as that described in Somerville, et al. [3.4]. The critical seismic sources and their characterization developed as part of the deterministic ground motion parameters (Section 3103F.4.2.7) should be used to evaluate the directivity effects. The resulting adjustments in spectral acceleration values may be applied in the probabilistic spectral acceleration values developed per Section 3103F.4.2.4 or 3103F.4.2.5. Such adjustment can be independent of the probability levels of spectral accelerations.*
2. *Directivity effects may be incorporated in the results of site specific PSHA per Section 3103F.4.2.3. In this case, the directivity effects will also depend on the probability level of spectral accelerations.*

If spectral accelerations are obtained in this manner, the effects of site amplification using either Section 3103F.4.2.4, 3103F.4.2.5 or an equivalent method (if justified) shall be incorporated.

3103F.4.2.7 Deterministic earthquake motions. *Deterministic ground motions from "scenario" earthquakes may be used for comparison purposes. Deterministic peak ground accelerations and spectral accelerations may be obtained using the "Critical Seismic Source" with maximum earthquake magnitude and its closest appropriate distance to the MOT. "Critical Seismic Source" is that which results in the largest computed median peak ground acceleration and spectral acceleration values when appropriate attenuation relationships are used. The values obtained from multiple attenuation relationships should be used to calculate the median peak ground acceleration and spectral acceleration values.*

For comparison, the values of peak ground accelerations and spectral accelerations may be obtained from the USGS maps, corresponding to the Maximum Considered Earthquake (MCE). In this case, the median values of peak ground acceleration and spectral acceleration values shall be 2/3 (see Section 1.6 of FEMA 356 [3.2]) of the values shown on the USGS maps.

3103F.4.2.8 Design Earthquake Magnitude. *The Design Earthquake Magnitude used in developing site-specific acceleration time histories (Section 3103F.4.2.10) or liquefaction assessment (Section 3106F.4) is obtained using either of the following two methods:*

1. *The design earthquake may be selected as the largest earthquake magnitude associated with the critical seismic source. The distance shall be taken as the closest distance from the source to the site. The resulting design earthquake shall be associated with all DPGA values for the site, irrespective of probability levels.*
2. *The design earthquake (DEQ) may be obtained for each DPGA or DSA value and associated probability level by determining the corresponding dominant distance and magnitude. These are the values of the distance and magnitude that contribute the most to the mean seismic hazards estimates for the probability of interest. They are usually determined by locating the summits of the 3-D surface of contribution of each small interval of magnitude and distance to the total mean hazards estimate. If this 3-D surface shows several modes with approximate weight of more than 20 percent of the total, several DEQs may be considered, and the DEQ leading to the most conservative design parameters shall be used.*

3103F.4.2.9 Design Spectral Acceleration for various damping values. *Design Spectral Acceleration (DSA) values at damping other than 5 percent shall be obtained by using a procedure given in Chapter 1 of FEMA 356 [3.2], and is denoted as DSA_d. The following procedure does not include near-fault directivity effects.*

For $0 < T < 0.2\ T_0$

Equation 3-8 $DSA_d = S_{XS}[(5/B_S - 2)\ T/T_0 + 0.4]$

For $0.2\ T_0 < T < T_0$

Equation 3-9 $DSA_d = DSA/B_S$

For $T > T_0$

Equation 3-10 $DSA_d = S_1/(B_1\ T)$

where:

T = period

$T_0 = S_{X1}/S_{XS}$

B_S = Coefficient used to adjust the short period spectral response, for the effect of viscous damping.

B_1 = Coefficient used to adjust one-second period spectral response, for the effect of viscous damping

Values of B_S and B_1 are obtained from Table 31F-3-5.

Such a procedure shall incorporate the near-fault directivity effects when the MOT is 15 km (9.3 miles) or closer to a significant seismic source.

TABLE 31F-3-5—VALUES OF B_S AND B_1 [3.2]

DAMPING (%)	B_S	B_1
< 2	0.8	0.8
5	1.0	1.0
10	1.3	1.2
20	1.8	1.5
30	2.3	1.7
40	2.7	1.9
> 50	3.0	2.0

Note: Linear interpolation should be used for damping values not specifically listed.

3103F.4.2.10 Development of acceleration time histories. *When acceleration time histories are utilized, target spectral acceleration values shall be initially selected corresponding to the DSA values at appropriate probability levels. For each set of target spectral acceleration values corresponding to one probability level, at least three sets of horizontal time histories (one or two horizontal acceleration time histories per set) shall be developed.*

Initial time histories shall consider magnitude, distance and the type of fault that are reasonably similar to those associated with the conditions contributing most to the probabilistic DSA values. Preferred initial time histories should have their earthquake magnitude and distance to the seismic source similar to the mode-magnitude and mode-distance derived from the PSHA or from appropriate maps. When an adequate number of recorded time histories are not available, acceleration time histories from simulations may be used as supplements.

Scaling or adjustments, either in the frequency domain or in the time domain (preferably), prior to generating acceleration time histories should be kept to a minimum. When the target spectral accelerations include near-fault directivity effects (Section 3103F.4.2.6), the initial time histories should exhibit directivity effects.

When three sets of time histories are used in the analysis, the envelope of the spectral acceleration values from each time history shall be equal to or higher than the target spectral accelerations. If the envelope values fall below the target values, adjustments shall be made to ensure that the spectral acceleration envelope is higher than target spectral accelerations. If the envelope is not higher, then a justification shall be provided.

When seven or more sets of time histories are used, the average of the spectral acceleration values from the set of time histories shall be equal or higher than the target spectral acceleration values. If the average values fall below the target values, adjustments shall be made to ensure that average values are higher than the target spectral accelerations. If this is not the case, then an explanation for the use of these particular spectral acceleration values shall be provided.

When three sets of time histories are used in the analysis, the maximum value of each response parameter shall be used in the design, evaluation and rehabilitation. When seven or more sets of time histories are used in the analysis, the average value of each response parameter may be used.

3103F.5 Mooring loads on vessels.

3103F.5.1 General. *Forces acting on a moored vessel may be generated by wind, waves, current, tidal variations, tsunamis, seiches and hydrodynamic effects of passing vessels. Forces from wind and current acting directly on the MOT structure (not through the vessel in the form of mooring and/ or breasting loads) shall be determined in Section 3103F.7.*

The vessel's moorings shall be strong enough to hold during all expected environmental and passing vessel conditions (see Section 3105F), while adequately accommodating changes in draft, surge, sway, yaw and tide.

3103F.5.2 Wind loads. *Wind loads on a vessel, moored at a MOT, shall be determined using procedures described in this section. Wind speed measured at an elevation of 33 feet (10 meters) above the water surface, with duration of 30 seconds shall be used to determine the design wind speed and wind limits for moored vessels. If these conditions are not met, adjustment factors shall be applied per Sections 3103F.5.2.2.*

3103F.5.2.1 Design wind speed. *For new MOTs, the 25-year return period shall be used to establish the design wind speed for each direction. The design wind speed is the maximum wind speed of 30-second duration used in the mooring analysis (see Section 3105F). The 30-second duration wind speed shall be determined from the annual maximum wind data. Average annual summaries cannot be used. Maximum wind speed data for a minimum of eight directions (45-degree increments) shall be obtained. If other duration wind data is available, it shall be adjusted to a 30-second duration, in accordance with Equation (3-*12).

3103F.5.2.2 Wind limits for moored vessels. *Wind loads shall be calculated for each of the load cases identified in Section 3105F.2. Wind velocity limits for moored vessels shall be presented in the Terminal Operating Limits (see Section 3102F.3.6.1 and Figure 31F-2-1) for each of the conditions given below.*

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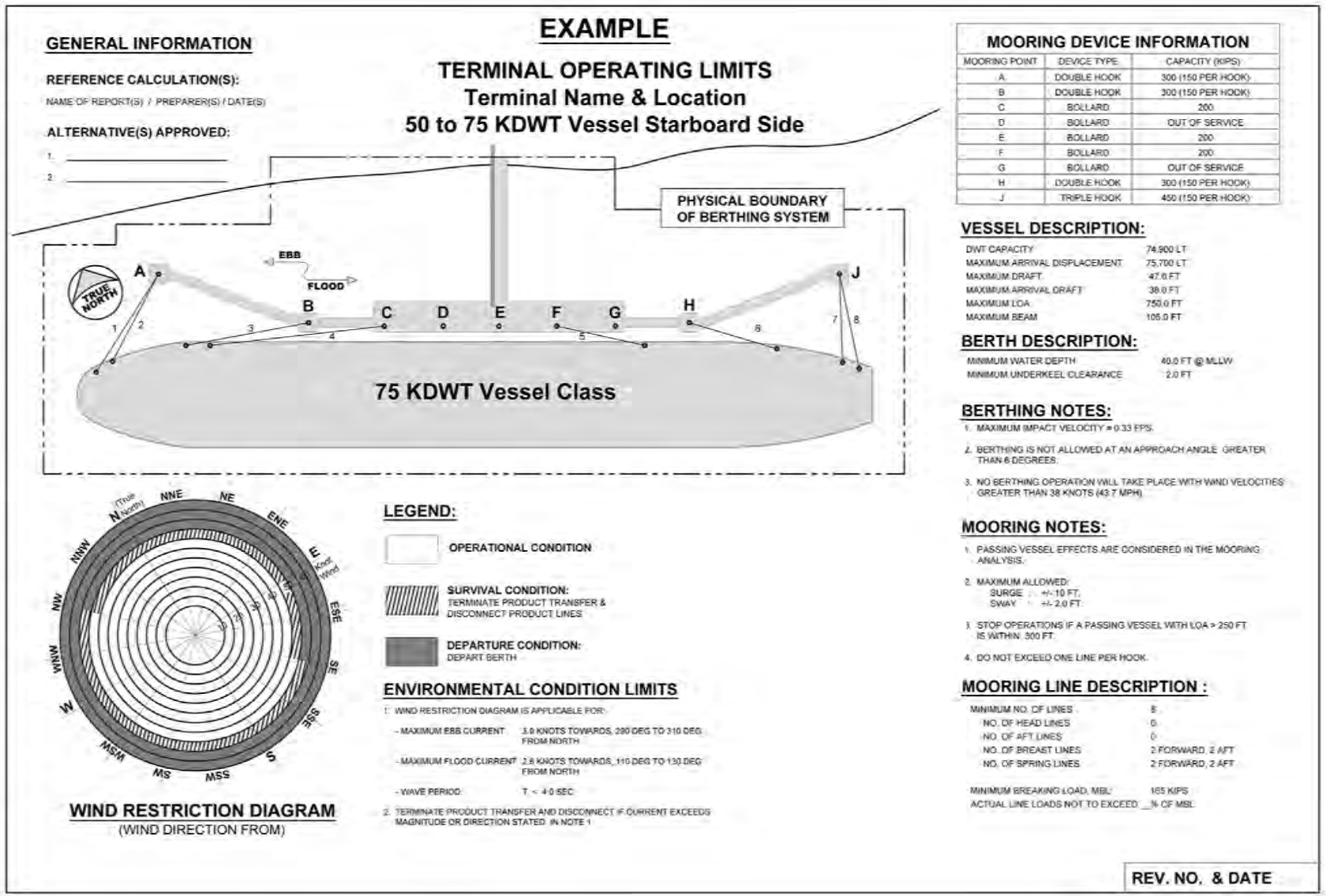
FIGURE 31F-2-1


EXAMPLE
GENERAL INFORMATION
REFERENCE CALCULATION(S):
NAME OF REPORT(S) / PREPARER(S) / DATE(S)
ALTERNATIVE(S) APPROVED:
1. _____
2. _____
TERMINAL OPERATING LIMITS
Terminal Name & Location
50 to 75 KDWT Vessel Starboard Side
PHYSICAL BOUNDARY OF BERTHING SYSTEM
EBB
FLOOD
TRUE NORTH
A
B
C
D
E
F
G
H
J
1
2
3
4
5
6
7
8
75 KDWT Vessel Class
MOORING DEVICE INFORMATION
MOORING POINT | DEVICE TYPE | CAPACITY (KIPS)
A | DOUBLE HOOK | 300 (150 PER HOOK)
B | DOUBLE HOOK | 300 (150 PER HOOK)
C | BOLLARD | 200
D | BOLLARD | OUT OF SERVICE
E | BOLLARD | 200
F | BOLLARD | 200
G | BOLLARD | OUT OF SERVICE
H | DOUBLE HOOK | 300 (150 PER HOOK)
J | TRIPLE HOOK | 450 (150 PER HOOK)
VESSEL DESCRIPTION:
DWT CAPACITY 74,900 LT
MAXIMUM ARRIVAL DISPLACEMENT 75,700 LT
MAXIMUM DRAFT 47.6 FT
MAXIMUM ARRIVAL DRAFT 38.0 FT
MAXIMUM LOA 750.0 FT
MAXIMUM BEAM 105.0 FT
BERTH DESCRIPTION:
MINIMUM WATER DEPTH 40.0 FT @ MLLW
MINIMUM UNDERKEEL CLEARANCE 2.0 FT
BERTHING NOTES:
1. MAXIMUM IMPACT VELOCITY = 0.33 FPS.
2. BERTHING IS NOT ALLOWED AT AN APPROACH ANGLE GREATER THAN 6 DEGREES.
3. NO BERTHING OPERATION WILL TAKE PLACE WITH WIND VELOCITIES GREATER THAN 38 KNOTS (43.7 MPH).
MOORING NOTES:
1. PASSING VESSEL EFFECTS ARE CONSIDERED IN THE MOORING ANALYSIS.
2. MAXIMUM ALLOWED:
SURGE : +/- 10 FT;
SWAY : +/- 2.0 FT
3. STOP OPERATIONS IF A PASSING VESSEL WITH LOA > 250 FT IS WITHIN 300 FT.
4. DO NOT EXCEED ONE LINE PER HOOK.
MOORING LINE DESCRIPTION :
MINIMUM NO. OF LINES 8
NO. OF HEAD LINES 0
NO. OF AFT LINES 0
NO. OF BREAST LINES 2 FORWARD, 2 AFT
NO. OF SPRING LINES 2 FORWARD, 2 AFT
MINIMUM BREAKING LOAD, MBL: 165 KIPS
ACTUAL LINE LOADS NOT TO EXCEED __% OF MBL
N (True North)
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
Knot Wind
WIND RESTRICTION DIAGRAM
(WIND DIRECTION FROM)
LEGEND:
OPERATIONAL CONDITION
SURVIVAL CONDITION:
TERMINATE PRODUCT TRANSFER & DISCONNECT PRODUCT LINES
DEPARTURE CONDITION:
DEPART BERTH
ENVIRONMENTAL CONDITION LIMITS
1. WIND RESTRICTION DIAGRAM IS APPLICABLE FOR:
- MAXIMUM EBB CURRENT: 3.9 KNOTS TOWARDS, 290 DEG TO 310 DEG FROM NORTH
- MAXIMUM FLOOD CURRENT: 2.8 KNOTS TOWARDS, 110 DEG TO 130 DEG FROM NORTH
- WAVE PERIOD: T < 4.0 SEC
2. TERMINATE PRODUCT TRANSFER AND DISCONNECT IF CURRENT EXCEEDS MAGNITUDE OR DIRECTION STATED IN NOTE 1
REV. NO. & DATE

3103F.5.2.2.1 Operational condition. *The operational condition is defined as the wind envelope in which a vessel may conduct transfer operations, as determined from the mooring analysis (Section 3105F). Transfer operations shall cease when the wind exceeds the maximum velocity of the envelope.*

3103F.5.2.2.2 Survival condition. *The survival condition is defined as the state wherein a vessel can remain safely moored at the berth during severe winds; however, loading arms and hoses shall be disconnected (see Sections 3110F.2 and 3110F.3 regarding movement limits of loading arms and hoses, respectfully). The survival condition is the wind zone between the operational condition and the departure condition (defined in Section 3103F.5.2.2). In this wind zone, the vessel must prepare to depart the berth.*

3103F.5.2.2.3 Departure condition. *The departure condition is defined as the wind state above which a vessel can no longer remain safely moored at the berth during severe winds, as determined from the mooring analysis (Section 3105F). For a new MOT, the departure condition threshold is the maximum wind velocity, for a 30-second gust and a 25-year return period, obtained from historical data. If the wind rises above these levels, the vessel must depart the berth.*

3103F.5.2.3 Wind speed corrections. *Wind speed measured at an elevation of 33 feet (10 meters) above the water surface, with duration of 30 seconds shall be used to determine the design wind speed. If these conditions are not met, the following corrections shall be applied.*

The correction for elevation is obtained from the equation:

Equation 3-11 $$V_w = V_h\left(\frac{33}{h}\right)^{1/7}$$

where:

V_w *= wind speed at elevation 33 ft. (10 m.)*

V_h *= wind speed at elevation h*

h *= elevation above water surface of wind data [feet]*

The available wind duration shall be adjusted to a 30-second value, using the following formula:

Equation 3-12 $$V_{t\,=\,30\ sec} = \frac{V_t}{c_t}$$

where:

$V_{t\,=\,30\,sec}$ *= wind speed for a 30-second duration*

V_t *= wind speed over a given duration*

c_t *= conversion factor from Figure 31F-3-1*

If wind data is available over land only, the following equation shall be used to convert the wind speed from over-land to over-water conditions [3.5]:

Equation 3-13 $$V_w = 1.10\,V_L$$

where:

V_w *= over water wind speed*

V_L *= over land wind speed*

3103F.5.2.4 Static wind loads on vessels. *The OCIMF MEG3 [3.6] shall be used to determine the wind loads for all tank vessels.*

Alternatively, wind loads for any type of vessel may be calculated using the guidelines in Ferritto et al. [3.7].

3103F.5.3 Current loads.

3103F.5.3.1 Design current velocity. *Maximum ebb and flood currents, annual river runoffs and controlled releases shall be considered when establishing the design current velocities for both existing and new MOTs.*

Local current velocities may be obtained from NOAA [3.8] or other sources, but must be supplemented by site-specific data, if the current velocity is higher than 1.5 knots.

Site-specific data shall be obtained by real time measurements over a one-year period. If this information is not available, a safety factor of 1.25 shall be applied to the best available data until real time measurements are obtained.

If the facility is not in operation during annual river runoffs and controlled releases, the current loads may be adjusted.

Operational dates need to be clearly stated in the definition of the Terminal Operating Limits (see Section 3102F.3.6.1 and Figure 31F-2-1).

3103F.5.3.2 Current velocity adjustment factors. *An average current velocity (V_c) shall be used to compute forces and moments. If the current velocity profile is known, the average current velocity can be obtained from the following equation:*

Equation 3-14 $$V_c^2 = (1/T)\int_o^T (v_c)^2\,ds$$

where:

V_c *= average current velocity (knots)*

T = draft of vessel

v_c = current velocity as a function of depth (knots)

s = water depth measured from the surface

If the velocity profile is not known, the velocity at a known water depth shall be adjusted by the factors provided in Figure 31F-3-2 to obtain the equivalent average velocity over the draft of the vessel.

FIGURE 31F-3-1—WIND SPEED CONVERSION FACTOR [3.5]

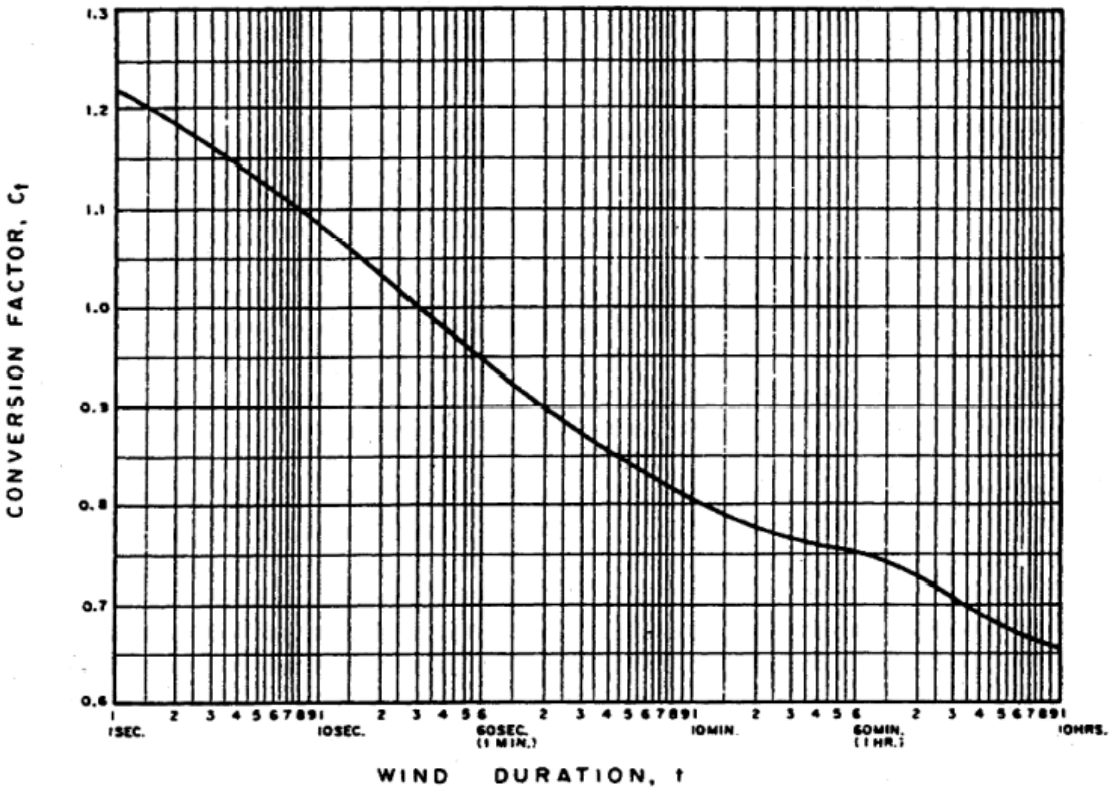


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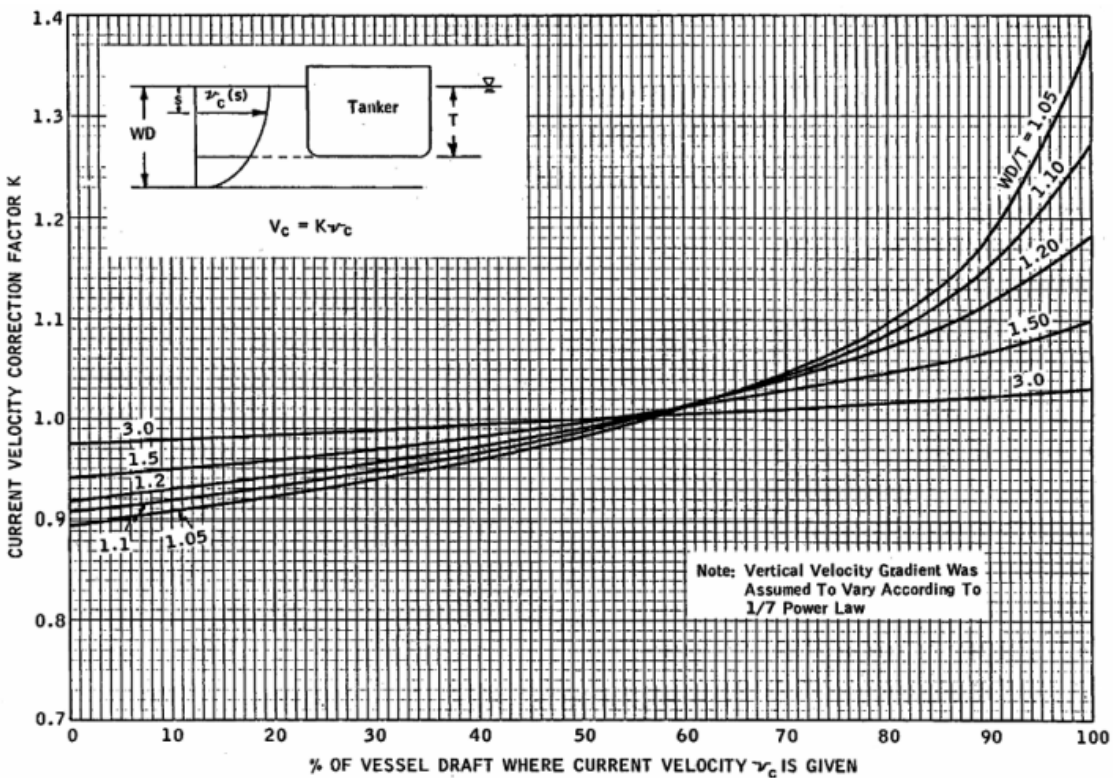
FIGURE 31F-3-2—CURRENT VELOCITY CORRECTION FACTOR (p. 23 [3.6])



3103F.5.3.3 Static current loads. *The OCIMF MEG3 [3.6] or the UFC 4-159-03 [3.9] procedures shall be used to determine current loads for moored tank vessels.*

3103F.5.3.4 Sea level rise (SLR). *All MOTs shall consider the predicted SLR over the remaining life of the terminal, due to subsidence or climate change combined with maximum high tide and storm surge. Consideration shall include but not be limited to variation in fender locations, additional berthing loads (deeper draft vessels) and any components near the splash zone.*

3103F.5.4 Wave loads. *When the significant wave period, T_s, is greater than 4 seconds (see Section 3105F.3.1), the transverse wave induced vessel reactions shall be calculated using a simplified dynamic mooring analysis described below.*

The horizontal water particle accelerations shall be calculated for the various wave conditions, taken at the mid-depth of the loaded vessel draft. The water particle accelerations shall then be used to calculate the wave excitation forces to determine the static displacement of the vessel. The Froude-Krylov method discussed in Chakrabarti's Chapter 7 [3.10] may be used to calculate the wave excitation forces, by conservatively approximating the vessel as a rectangular box with dimensions similar to the actual dimensions of the vessel. The horizontal water particle accelerations shall be calculated for the various wave conditions, taken at the mid-depth of the loaded vessel draft. The computed excitation force assumes a 90-degree incidence angle with the longitudinal axis of the vessel, which will result in forces that are significantly greater than the forces that will actually act upon the vessel from quartering seas. A load reduction factor may be used to account for the design wave incidence angle from the longitudinal axis of the ship. The overall excursion of the vessel shall be determined for each of the wave conditions by calculating the dynamic response of the linear spring mass system.

3103F.5.5 Passing vessels. *When required in Section 3105F.3, the sway and surge forces, as well as yaw moment, on a moored vessel, due to passing vessels, shall be established considering the following:*

1. *Ratio of length of moored vessel to length of passing vessel.*
2. *Distance from moored vessel to passing vessel.*
3. *Ratio of midship section areas of the moored and passing vessels.*
4. *Underkeel clearances of the moored and passing vessels.*
5. *Draft and trim of the moored vessel and draft of the passing vessel.*
6. *Mooring line tensions.*

The passing vessel's speed should take into consideration the ebb or flood current. Normal operating wind and current conditions can be assumed when calculating forces due to a passing vessel. Either method of Kriebel [3.11] or Wang [3.12] may be used to determine forces on a moored vessel. Kriebel's recent wave tank study improves on an earlier work of Seelig [3.13].

3103F.5.6 Seiche. *The penetration of long period low amplitude waves into a harbor can result in resonant standing wave systems, when the wave forcing frequency coincides with a natural frequency of the harbor. The resonant standing waves can result in large*

surge motions if this frequency is close to the natural frequency of the mooring system. Section 3105F.3.3 prescribes the procedure for the evaluation of these effects.

3103F.5.7 Tsunamis. *A tsunami may be generated by an earthquake or a subsea or coastal landslide, which may induce large wave heights and excessive currents. The large wave or surge and the excessive currents are potentially damaging, especially if there is a tank vessel moored alongside the MOT wharf.*

Tsunamis can be generated either by a distant or near source. A tsunami generated by a distant source (far field event) may allow operators to have an adequate warning for mitigating the risk by allowing the vessels to depart the MOT and go into deep water. For near-field events, with sources less than 500 miles away, the vessel may not have adequate time to depart. Each MOT shall have a "tsunami plan" describing what actions will be performed, in the event of a distant tsunami.

Recent tsunami studies have been completed for both Southern and Northern California. For the Ports of Los Angeles and Long Beach, one of these recent studies focused on near field tsunamis with predicted return periods of 5,000 to 10,000 years [3.14]. These maximum water levels (run-up) would not normally be used for MOT design. However, because the study also provides actual tidal records from recent distant tsunamis, it should be used for design.

The run-up value for Port Hueneme was obtained from an earlier study by Synolakis et al. [3.15].

Run up-values: Port of Los Angeles and Long Beach = 8 ft.

Port Hueneme = 11 ft.

For the San Francisco Bay, a recent study provides the maximum credible tsunami water levels and current speeds. These results are deterministic and are based on the most severe seismic sources that could reasonably impact MOTs in the San Francisco Bay [3.16]. Table 31F-3-6 provides values for the marine oil terminal locations within San Francisco Bay. Water levels could be positive or negative and current velocities may vary in direction. In order to determine the maximum run-up at a MOT, the largest values should be added to the mean high tide. Further details are available in [3.16].

Loads from tsunami-induced waves can be calculated for various structural configurations [3.17]. Tsunami wave heights in shallow water and particle kinematics can also be obtained. Other structural considerations include uplift and debris impact.

TABLE 31F-3-6—TSUNAMI RUN-UP VALUES (ft) AND CURRENT SPEEDS (ft/sec) IN THE SAN FRANCISCO BAY AREA (AFTER [3.16])

S.F. BAY LOCALE	MAXIMUM WATER LEVELS (ft.)	CURRENT VELOCITY (ft/sec)
Richmond, outer	7.5	4.9
Richmond, inner	7.9	8.9
Martinez	2.3	1.3
Selby	2.6	1.6
Rodeo	2.6	2.0
Benicia	2.0	1.0

3103F.6 Berthing Loads.

3103F.6.1 General. *Berthing loads are quantified in terms of transfer of kinetic energy of the vessel into potential energy dissipated by the fender(s). The terms and equations below are based on those in UFC 4-152-01 [3.18] and PIANC [3.19].*

Kinetic energy shall be calculated from the following equation:

Equation 3-15 $$E_{vessel} = \frac{1}{2} \cdot \frac{W}{g} \cdot V_n^2$$

where:

E_{vessel} *= Berthing energy of vessel [ft-lbs]*

W *= Total weight of vessel and cargo in pounds [long tons × 2240]*

g *= Acceleration due to gravity [32.2 ft/sec^2]*

V_n *= Berthing velocity normal to the berth [ft/sec]*

The following correction factors shall be used to modify the actual energy to be absorbed by the fender system for berthing operations:

Equation 3-16 $$E_{fender} = F_A \cdot C_b \cdot C_m \cdot E_{vessel}$$

where:

E_{fender} *= Energy to be absorbed by the fender system*

F_A *= Accidental factor accounting for abnormal conditions such as human error, malfunction, adverse environmental conditions or a combination of these factors. For existing berthing systems, F_A may be taken as 1.0. For new berthing systems, F_A shall be determined in accordance with Section 5-1.5.3 of UFC 4-152-01 [3.18] or PIANC Section 4.2.8 [3.19].*

C_b *= Berthing Coefficient*

C_m *= Effective mass or virtual mass coefficient (see Section 3103F.6.6)*

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The berthing coefficient, C_b, is given by:

Equation 3-17 $C_b = C_e \cdot C_g \cdot C_d \cdot C_c$

where:

C_e = Eccentricity Coefficient

C_c = Configuration Coefficient

C_g = Geometric Coefficient

C_d = Deformation Coefficient

These coefficients are defined in Sections 3103F.6.2 through 3103F.6.5.

The approximate displacement of the vessel (when only partially loaded) at impact, DT, can be determined from an extension of an equation from Gaythwaite [3.20]:

Equation 3-18 $DT = 1.25\ DWT(d_{actual}/d_{max})$

where:

DWT = Dead Weight Tonnage (in long tons)

d_{actual} = Actual arrival draft of the vessel

d_{max} = Maximum loaded vessel draft

The berthing load shall be based on the fender reaction due to the kinetic berthing energy. The structural capacity shall be established based on allowable concrete, steel or timber properties in the structural components, as defined in Section 3107F.

For fender system selection, Section 3105F.4.5 shall be followed.

3103F.6.2 Eccentricity coefficient (C_e). *During the berthing maneuver, when the vessel is not parallel to the berthing line (usually the wharf face), not all the kinetic energy of the vessel will be transmitted to the fenders. Due to the reaction from the fender(s), the vessel will start to rotate around the contact point, thus dissipating part of its energy. Treating the vessel as a rigid rod of negligible width in the analysis of the energy impact on the fenders leads to the equation:*

Equation 3-19 $$C_e = \frac{k^2}{a^2 + k^2}$$

where:

k = Longitudinal radius of gyration of the vessel [ft]

a = Distance between the vessel's center of gravity and the point of contact on the vessel's side, projected onto the vessel's longitudinal axis [ft]

3103F.6.3 Geometric coefficient (C_g). *The geometric coefficient, C_g, depends upon the geometric configuration of the ship at the point of impact. It varies from 0.85 for an increasing convex curvature to 1.25 for concave curvature. Generally, 0.95 is recommended for the impact point at or beyond the quarter points of the ship, and 1.0 for broadside berthing in which contact is made along the straight side [3.18].*

3103F.6.4 Deformation coefficient (C_d). *This accounts for the energy reduction effects due to local deformation of the ships hull and deflection of the whole ship along its longitudinal axis. The energy absorbed by the ship depends on the relative stiffness of the ship and the obstruction. The deformation coefficient varies from 0.9 for a nonresilient fender to nearly 1.0 for a flexible fender. For larger ships on energy-absorbing fender systems, little or no deformation of the ship takes place; therefore, a coefficient of 1.0 is recommended.*

3103F.6.5 Configuration coefficient (C_c). *This factor accounts for the difference between an open pier or wharf and a solid pier or wharf. In the first case, the movements of the water surrounding the berthing vessel is not (or is hardly) affected by the berth. In the second case, the water between the berthing vessel and the structure introduces a cushion effect that represents an extra force on the vessel away from the berth and reduces the energy to be absorbed by the fender system.*

For open berth and corners of solid piers, $C_c = 1.0$

For solid piers with parallel approach, $C_c = 0.8$

For berths with different conditions, C_c may be interpolated between these values [3.18].

3103F.6.6 Effective mass or virtual mass coefficient (C_m). *In determining the kinetic energy of a berthing vessel, the effective or the virtual mass is the sum of vessel mass and hydrodynamic mass. The hydrodynamic mass does not necessarily vary with the mass of the vessel, but is closely related to the projected area of the vessel at right angles to the direction of motion.*

Other factors, such as the form of vessel, water depth, berthing velocity and acceleration or deceleration of the vessel, will have some effect on the hydrodynamic mass. Taking into account both model and prototype experiments, the effective or virtual mass coefficient can be estimated as:

Equation 3-20 $$C_m = 1 + 2 \cdot \frac{d_{actual}}{B}$$

where:

d_{actual} = Actual arrival draft of the vessel

B = Beam of vessel

The value of C_m for use in design should be a minimum of 1.5 and need not exceed 2.0 [3.18].

3103F.6.7 Berthing velocity and angle. *The berthing velocity, V_n, is influenced by a large number of factors such as environmental conditions of the site (wind, current and wave), method of berthing (with or without tugboat assistance), condition of the vessel during berthing (ballast or fully laden) and human factors (experience of the tugboat captain).*

The berthing velocity, normal to berth, shall be in accordance with Table 31F-3-7. Site condition is determined from Table 31F-3-8.

Subject to Division approval, if an existing MOT can demonstrate lower velocities by utilizing velocity monitoring equipment, then such a velocity may be used temporarily until the berthing system is compliant with this Code.

In order to obtain the normal berthing velocity, V_n, an approach angle, defined as the angle formed by the fender line and the longitudinal axis of the vessel must be determined. The berthing angles, used to compute the normal berthing velocity, for various vessel sizes are shown in Table 31F-3-9.

TABLE 31F-3-7—BERTHING VELOCITY V_n (NORMAL TO BERTH)[1]

VESSEL SIZE (DWT)	TUG BOAT ASSISTANCE	SITE CONDITIONS		
		Unfavorable	Moderate	Favorable
≤ 10,000	No	1.31 ft/sec	0.98 ft/sec	0.53 ft/sec
≤ 10,000	Yes	0.78 ft/sec	0.66 ft/sec	0.33 ft/sec
50,000	Yes	0.53 ft/sec	0.39 ft/sec	0.26 ft/sec
≥ 100,000	Yes	0.39 ft/sec	0.33 ft/sec	0.26 ft/sec

1. For vessel sizes not shown, interpolation between velocities may be used.

TABLE 31F-3-8—SITE CONDITIONS

SITE CONDITIONS	DESCRIPTION	WIND SPEED[1]	SIGNIFICANT WAVE HEIGHT	CURRENT SPEED[2]
Unfavorable	Strong Wind Strong Currents High Waves	> 38 knots	> 6.5 ft	> 2 knots
Moderate	Strong Wind Moderate Current Moderate Waves	≥ 38 knots	≤ 6.5 ft	≤ 2 knots
Favorable	Moderate Wind Moderate Current Moderate Waves	< 38 knots	< 6.5 ft	< 2 knots

1. A 30-second duration measured at a height of 33 ft.
2. Taken at 0.5 x water depth

TABLE 31F-3-9—BERTHING ANGLE

VESSEL SIZE (DWT)	ANGLE (degrees)
Barge	15
< 10,000	10
10,000-50,000	8
> 50,000	6

3103F.7 Wind and current loads on structures.

3103F.7.1 General. *This section provides methods to determine the wind and current loads acting on the structure directly, as opposed to wind and current forces acting on the structure from a moored vessel.*

3103F.7.2 Wind loads. *Chapter 29 of ASCE/SEI 7 [3.21] shall be used to establish minimum wind loads on the structure. Additional information about wind loads may be obtained from Simiu and Scanlan [3.22].*

3103F.7.3 Current loads. *The current forces acting on the structure may be established using the current velocities, per Section 3103F.5.3.*

3103F.8 Load combinations. *As a minimum, each component of the structure shall be analyzed for all applicable load combinations given in Table 31F-3-10 or Table 31F-3-11, depending on component type. For additional load combinations, see UFC 4-152-01 [3.18].*

The "vacant condition" is the case wherein there is no vessel at the berth. The "mooring and breasting condition" exists after the vessel is securely tied to the wharf. The "berthing condition" occurs as the vessel impacts the wharf, and the "earthquake condition" assumes no vessel is at the berth, and there is no wind or current forces on the structure.

The use of various load types is discussed below:

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3103F.8.1 Dead load (D). *Upper and lower bound values of dead load are applied for the vacant condition to check the maximum moment and shear with minimum axial load.*

3103F.8.2 Live load (L). *Typically, the live load on MOTs is small and may be neglected for combinations including earthquake loads. However, in some cases, a higher value of live load may be warranted depending on MOT use, and an appropriate value of live load shall be considered for combinations including earthquake loads.*

3103F.8.3 Buoyancy load (B). *Buoyancy forces shall be considered for any submerged or immersed substructures (including pipelines, sumps and structural components).*

3103F.8.4 Wind (W) and current (C) on the structure. *Wind and currents on the vessel are included in the mooring and breasting condition. The wind and current loads acting on the structure are therefore additional loads that can act simultaneously with the mooring, breasting and/or berthing loads.*

3103F.8.5 Earth pressure on the structure (H). *The soil pressure on end walls, typically concrete cut-off walls, steel sheet pile walls on wharf type structures and/or piles shall be considered.*

3103F.8.6 Mooring line/breasting loads (M). *Mooring line and breasting loads can occur simultaneously or individually, depending on the combination of wind and current. Multiple load cases for operating and survival conditions may be required (see Sections 3103F.5.2 and 3105F.2). In addition, loads caused by passing vessels shall be considered for the "mooring and breasting condition." Refer to Sections 3105F.2 and 3105F.3 for the determination of mooring line and breasting loads.*

3103F.8.7 Berthing load (B_e). *Berthing is a frequent occurrence, and shall be considered as a normal operating load. No increase in allowable stresses shall be applied for ASD.*

3103F.8.8 Earthquake loads (E). *Performance based seismic analysis methodology requires that the actual displacement demand be limited to defined strains in concrete, steel and timber. For the deck and pile evaluation, two cases of dead load (upper and lower bound) shall be considered in combination with the seismic load.*

TABLE 31F-3-10—LRFD LOAD FACTORS FOR LOAD COMBINATIONS [3.18]

LOAD TYPE	VACANT CONDITION		MOORING & BREASTING CONDITION	BERTHING CONDITION	EARTHQUAKE CONDITION[3]	
Dead Load (D)	1.2	0.9	1.2	1.2	$1.2 + k^1$	$0.9\text{-}k^1$
Live Load (L)	1.6	—	1.6[2]	1.0	1.0	—
Buoyancy (B)	1.2	0.9	1.2	1.2	1.2^1	0.9^1
Wind on Structure (W)	1.6	1.6	1.6	1.6	—	—
Current on Structure (C)	1.2	0.9	1.2	1.2	1.2	0.9
Earth Pressure on the Structure (H)	1.6	1.6	1.6	1.6	1.6^4	1.6^4
Mooring/Breasting Load (M)	—	—	1.6	—	—	—
Berthing Load (B_e)	—	—	—	1.6	—	—
Earthquake Load (E)	—	—	—	—	1.0	1.0

1. k = 0.50 (PGA) The k factor (k=0.5(PGA)) and buoyancy (B) shall be applied to the vertical dead load (D) only, and not to the inertial mass of the structure.
2. The load factor for live load (L) may be reduced to 1.3 for the maximum outrigger float load from a truck crane.
3. For Level 1 and 2 earthquake conditions with strain levels defined in Division 7, the current on structure (C) may not be required.
4. An earth pressure on the Structure factor (H) of 1.0 may be used for pile or bulkhead structures.

TABLE 31F-3-11—SERVICE OR ASD LOAD FACTORS FOR LOAD COMBINATIONS [3.18]

LOAD TYPE	VACANT CONDITION	MOORING & BREASTING CONDITION	BERTHING CONDITION	EARTHQUAKE CONDITION	
Dead Load (D)	1.0	1.0	1.0	$1 + 0.7k^1$	$1 - 0.7k^1$
Live Load (L)	1.0	1.0	0.75	0.75	—
Buoyancy (B)	1.0	1.0	1.0	1.0	0.6
Wind on Structure (W)	1.0	1.0	0.75	—	—
Current on Structure (C)	1.0	1.0	1.0	—	—
Earth Pressure on the Structure (H)	1.0	1.0	1.0	1.0	1.0
Mooring/Breasting Load (M)	—	1.0	—	—	—
Berthing Load (B_e)	—	—	1.0	—	—
Earthquake Load (E)	—	—	—	0.7	0.7
% Allowable Stress	100	100	100	100^2	

1. k = 0.5 (PGA)
2. Increase in allowable stress shall not be used with these load combinations unless it can be demonstrated that such increase is justified by structural behavior caused by rate or duration of load. See ASCE/SEI 7 [3.21]

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3103F.9 Miscellaneous loads. *Handrails and guardrails shall be designed for 25 plf with a 200-pound minimum concentrated load in any location or direction.*

3103F.10 Symbols.

a = Distance between the vessel's center of gravity and the point of contact on the vessel's side, projected onto the vessel's longitudinal axis [ft]

A = Site Class A as defined in Table 31F-6-1

B = Beam of vessel

B = Site Class B as defined in Table 31F-6-1

B_1 *= Coefficient used to adjust one-second period spectral response, for the effect of viscous damping*

B_s *= Coefficient used to adjust the short period spectral response, for the effect of visous damping.*

C = Site Class C as defined in Table 31F-6-1

C_b *= Berthing Coefficient*

C_c *= Configuration Coefficient*

C_g *= Geometric Coefficient*

C_d *= Deformation Coefficient*

C_e *= Eccentricity Coefficient*

C_m *= Effective mass or virtual mass coefficient*

C_t *= Windspeed conversion factor*

D = Site Class D as defined in Table 31F-6-1

DSA = Design Spectral Acceleration

DSA_d *= DSA values at damping other than 5 percent*

DT = Displacement of vessel

DWT = Dead weight tons

d_{actual} *= Arrival maximum draft of vessel at berth*

d_{max} *= Maximum vessel draft (in open seas)*

E = Site Class E as defined in Table 31F-6-1

E_{fender} *= Energy to be absorbed by the fender system*

E_{vessel} *= Berthing energy of vessel [ft-lbs]*

F = Site Class F as defined in Table 31F-6-1

F_a, F_v *= Site coefficients from Tables 31F-3-3 and 31F-3-4, respectively*

F_A *= Accidental factor accounting for abnormal conditions*

g *= Acceleration due to gravity [32.2 ft/sec^2]*

h = Elevation above water surface [feet]

k = Radius of longitudinal gyration of the vessel [ft]

K = Current velocity correction factor (Fig 31F-3-2)

PGA_X *= Peak ground acceleration corresponding to the site class under consideration.*

s = Water depth measured from the surface

S_a *= Spectral acceleration*

S_1 *= Spectral acceleration value (for the boundary of Site Classes B and C) at 1.0 second*

S_S *= Spectral acceleration value (for the boundary of Site Classes B and C) at 0.2 seconds*

S_{X1} *= Spectral acceleration value at 1.0 second corresponding to the period of* S_1 *and the site class under consideration*

S_{XS} *= Spectral acceleration value at 0.2 seconds corresponding to the period of* S_S *and the site class under consideration*

T = Draft of vessel (see Figure 31F-3-2)

T = Period [sec]

T_0 *= Period at which the constant acceleration and constant velocity regions of the design spectrum intersect*

V_c *= Average current velocity [knots]*

v_c *= Current velocity as a function of depth [knots]*

V_h *= Wind speed (knots) at elevation h*

V_L *= Over land wind speed*

V_n *= Berthing velocity normal to the berth [ft/sec]*

v_t = Velocity over a given time period

$V_{t=30sec}$ = Wind speed for a 30 second interval

V_w = Wind speed at 33-foot (10 m) elevation [knots]

W = Total weight of vessel and cargo inpounds [displacement tonnage × 2240]

WD = Water Depth (Figure 31F-3-2)

3103F.11 References.

[3.1] American Society of Civil Engineers (ASCE), 2017, ASCE/SEI 41-17 (ASCE/SEI 41), "Seismic Evaluation and Retrofit of Existing Buildings," Reston, VA.

[3.2] Federal Emergency Management Agency (FEMA), Nov. 2000, FEMA 356, "Prestandard and Commentary for the Seismic Rehabilitation of Buildings," Washington, D.C.

[3.3] Idriss, I.M. and Sun, J.I., 1992, "User's Manual for SHAKE91, A Computer Program for Conducting Equivalent Linear Seismic Response Analyses of Horizontally Layered Soil Deposits," Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, University of California, Davis, CA.

[3.4] Somerville, Paul G., Smith, Nancy F., Graves, Robert W., and Abrahamson, Norman A., 1997, "Modification of Empirical Strong Ground Motion Attenuation Relations to Include the Amplitude and Duration Effects of Rupture Directivity," Seismological Research Letters, Volume 68, Number 1, pp.199-222.

[3.5] Pile Buck Inc., 1992, "Mooring Systems, A Pile Buck Production," Jupiter, FL.

[3.6] Oil Companies International Marine Forum (OCIMF), 2008, "Mooring Equipment Guidelines (MEG3)," 3rd ed., London, England.

[3.7] Ferritto, J., Dickenson, S., Priestley N., Werner, S., Taylor, C., Burke, D., Seelig, W., and Kelly, S., 1999, "Seismic Criteria for California Marine Oil Terminals," Vol. 1 and Vol. 2, Technical Report TR-2103-SHR, Naval Facilities Engineering Service Center, Port Hueneme, CA.

[3.8] National Oceanic and Atmospheric Administration, Contact: National PORTS Program Manager, Center for Operational Oceanographic Products and Services, 1305 EW Highway, Silver Spring, MD 20910.

[3.9] Department of Defense, 3 October 2005 (Change 2, 23 June 2016), Unified Facilities Criteria (UFC) 4-159-03, "Design: Moorings," Washington, D.C.

[3.10] Chakrabarti, S. K., 1987, "Hydrodynamics of Offshore Structures," Computational Mechanics.

[3.11] Kriebel, David, "Mooring Loads Due to Parallel Passing Ships," Technical Report TR-6056-OCN, US Naval Academy, 30 September 2005.

[3.12] Wang, Shen, August 1975, "Dynamic Effects of Ship Passage on Moored Vessels," Journal of the Waterways, Harbors and Coastal Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 101, WW3, Reston, VA.

[3.13] Seelig, William N., 20 November 2001, "Passing Ship Effects on Moored Ships," Technical Report TR-6027-OCN, Naval Facilities Engineering Service Center, Washington, D.C.

[3.14] Moffatt & Nichol, April 2007, "Tsunami Hazard Assessment for the Ports of Long Beach and Los Angeles – FINAL REPORT," prepared for the Ports of Long Beach and Los Angeles.

[3.15] Synolakis, C., "Tsunami and Seiche," Chapter 9 in Earthquake Engineering Handbook, Chen, W., Scawthorn, C. S. and Arros, J. K., editors, 2002, CRC Press, Boca Raton, FL.

[3.16] Borrero, Jose, Dengler, Lori, Uslu, Burak and Synolakis, Costas, June 2006, "Numerical Modeling of Tsunami Effects at Marine Oil Terminals in San Francisco Bay," Report for the Marine Facilities Division of the California State Lands Commission.

[3.17] Camfield, Frederick E., February 1980, "Tsunami Engineering," U.S. Army, Corps of Engineers, Coastal Research Center, Special Report No. 6.

[3.18] Department of Defense, 24 January 2017, Unified Facilities Criteria (UFC) 4-152-01, "Design: Piers and Wharves," Washington, D.C

[3.19] Permanent International Association of Navigation Congresses (PIANC), 2002, "Guidelines for the Design of Fender Systems: 2002," Brussels.

[3.20] Gaythwaite, John, 2004, "Design of Marine Facilities for the Berthing, Mooring and Repair of Vessels," American Society of Civil Engineers, Reston, VA.

[3.21] American Society of Civil Engineers (ASCE), 2016, ASCE/SEI 7-16 (ASCE/SEI 7), "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," Reston, VA.

[3.22] Simiu, E. and Scanlan, R., 1978, "Wind Effects on Structures: An Introduction to Wind Engineering," Wiley-Interscience Publications, New York.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 4

SECTION 3104F—SEISMIC ANALYSIS AND STRUCTURAL PERFORMANCE

3104F.1 General.

3104F.1.1 Purpose. *The purpose of this section is to establish minimum standards for seismic analysis and structural performance. Seismic performance is evaluated at two criteria levels. Level 1 requirements define a performance criterion to ensure MOT functionality. Level 2 requirements safeguard against major damage, collapse or major oil spill.*

3104F.1.2 Applicability. *Section 3104F applies to all new and existing MOTs. Structures supporting loading arms, pipelines, oil transfer and storage equipment, critical systems and vessel mooring structures, such as mooring and breasting dolphins are included. Catwalks and similar components that are not part of the lateral load carrying system and do not support oil transfer equipment may be excluded.*

3104F.1.3 Configuration classification of MOT structure. *Each MOT structure shall be designated as regular or irregular based on torsional irregularity criteria presented in ASCE/SEI 7 [4.1]. An MOT structure is defined to be irregular when maximum displacement at one end of the MOT structure transverse to an axis is more than 1.2 times the average of the displacement at the two ends of the MOT structure, as described in Figure 31F-4-1. For MOTs with multiple segments separated by expansion joints, each segment shall be designated as regular or irregular using criteria in this section. Expansion joints in this context are defined as joints that separate each structural segment in such a manner that each segment will move independently during an earthquake.*

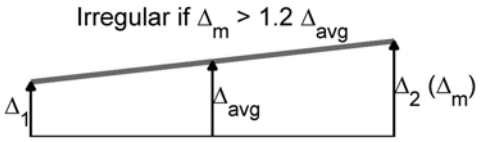

FIGURE 31F-4-1—DEFINITION OF IRREGULAR MOT

3104F.2 Existing MOTs

3104F.2.1 Seismic Performance Criteria. *Two levels of seismic performance shall be considered, except for critical systems (Section 3104F.5.1). These levels are defined as follows:*

Level 1 Seismic Performance:

- *Minor or no structural damage*
- *Temporary or no interruption in operations*

Level 2 Seismic Performance:

- *Controlled inelastic behavior with repairable damage*
- *Prevention of collapse*
- *Temporary loss of operations, restorable within months*
- *Prevention of major spill (≥ 1200 bbls)*

The Level 1 and Level 2 seismic performance criteria are defined in Table 31F-4-1.

TABLE 31F-4-1—SEISMIC PERFORMANCE CRITERIA[1, 2]

SPILL CLASSIFICATION[3]	SEISMIC PERFORMANCE LEVEL	PROBABILITY OF EXCEEDANCE	RETURN PERIOD
High	Level 1	50% in 50 years	72 years
	Level 2	10% in 50 years	475 years
Medium	Level 1	65% in 50 years	48 years
	Level 2	15% in 50 years	308 years
Low	Level 1	75% in 50 years	36 years
	Level 2	20% in 50 years	224 years

1. *For new MOTs, see Section 3104F.3.*
2. *For marine terminals transferring LNG, return periods of 72 and 475 years shall be used for Levels 1 and 2, respectively.*
3. *See Section 3101F.6 for spill classification.*

3104F.2.2 Basis for evaluation. *Component capacities shall be based on existing conditions, calculated as "best estimates," taking into account the mean material strengths, strain hardening and degradation overtime. The capacity of components with little or no ductility, which may lead to brittle failure scenarios, shall be calculated based on lower bound material strengths. Methods to establish component strength and deformation capacities for typical structural materials and components are provided in Section 3107F. Geotechnical considerations are discussed in Section 3106F.*

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3104F.2.3 Analytical procedures. *The objective of the seismic analysis is to verify that the displacement capacity of the structure is greater than the displacement demand, for each performance level defined in Table 31F-4-1. For this purpose, the displacement capacity of each element of the structure shall be checked against its displacement demand including the orthogonal effects of Section 3104F.4.2. The required analytical procedures are summarized in Table 31F-4-2.*

The displacement capacity of the structure shall be calculated using the nonlinear static (pushover) procedure. For the nonlinear static (pushover) procedure, the pushover load shall be applied at the target node defined as the center of mass (CM) of the MOT structure. It is also acceptable to use a nonlinear dynamic procedure for capacity evaluation, subject to peer review in accordance with Section 3101F.8.2.

Methods used to calculate the displacement demand are linear modal, nonlinear static and nonlinear dynamic.

Mass to be included in the displacement demand calculation shall include mass from self-weight of the structure, weight of the permanent equipment, and portion of the live load that may contribute to inertial mass during earthquake loading, such as a minimum of 25% of the floor live load in areas used for storage.

Any rational method, subject to the Division's approval, can be used in lieu of the required analytical procedures shown in Table 31F-4-2.

TABLE 31F-4-2—MINIMUM REQUIRED ANALYTICAL PROCEDURES

SPILL CLASSIFICATION[1]	CONFIGURATION	SUBSTRUCTURE MATERIAL	DISPLACEMENT DEMAND PROCEDURE	DISPLACEMENT CAPACITY PROCEDURE
High/Medium	Irregular	Concrete/Steel	Linear Modal	Nonlinear Static
High/Medium	Regular	Concrete/Steel	Nonlinear Static[2]	Nonlinear Static
Low	Regular/Irregular	Concrete/Steel	Nonlinear Static	Nonlinear Static
High/Medium/Low	Regular/Irregular	Timber	Nonlinear Static	Nonlinear Static

1. See Section 3101F.6 for spill classification.
2. Linear modal demand procedure may be required for cases where more than one mode is expected to contribute to the displacement demand.

3104F.2.3.1 Nonlinear static capacity procedure (pushover). *To assess displacement capacity, two-dimensional nonlinear static (pushover) analyses shall be performed; three-dimensional analyses are optional. A model that incorporates the nonlinear load deformation characteristics of all components for the lateral force-resisting system shall be used in the pushover analysis.*

Alternatively, displacement capacity of a pile in the MOT structure may be estimated from pushover analysis of an individual pile with appropriate axial load and pile-to-deck connection.

The displacement capacity of a pile from the pushover analysis shall be defined as the displacement that can occur at the top of the pile without exceeding plastic rotation (or material strain) limits, either at the pile-deck hinge or in-ground hinge, as defined in Section 3107F. If pile displacement has components along two axes, as may be the case for irregular MOTs, the pile displacement capacity shall be defined as the resultant of its displacement components along the two axes.

3104F.2.3.1.1 Modeling. *A series of nonlinear pushover analyses may be required depending on the complexity of the MOT structure. At a minimum, pushover analysis of a two-dimensional model shall be conducted in both the longitudinal and transverse directions. The piles shall be represented by nonlinear elements that capture the moment-curvature/rotation relationships for components with expected inelastic behavior in accordance with Section 3107F. The effects of connection flexibility shall be considered in pile-to-deck connection modeling. For prestressed concrete piles, Figure 31F-4-2 may be used. A nonlinear element is not required to represent each pile location. Piles with similar lateral force-deflection behavior may be lumped in fewer larger springs, provided that the overall torsional effects are captured.*

Linear material component behavior is acceptable where nonlinear response will not occur. All components shall be based on effective moment of inertia calculated in accordance with Section 3107F. Specific requirements for timber pile structures are discussed in the next section.

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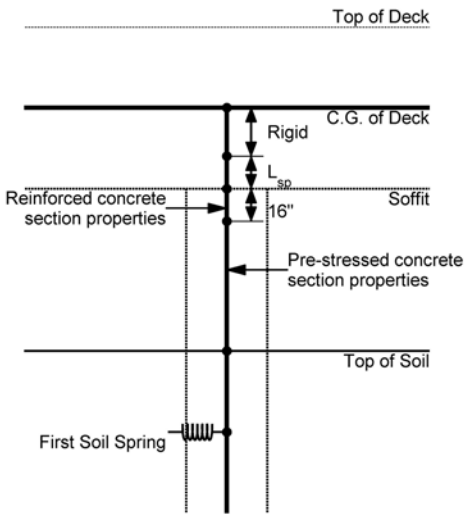
FIGURE 31F-4-2—PILE-DECK CONNECTION MODELING FOR PRESTRESSED CONCRETE PILE (ADAPTED FROM [4.2]

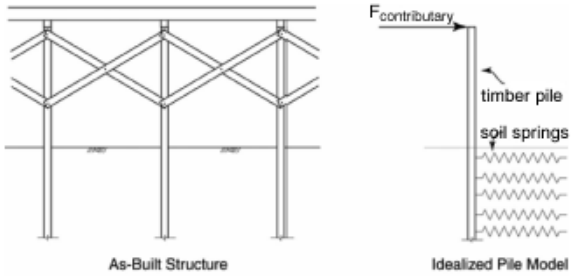


3104F.2.3.1.2 Timber pile supported structures. *For all timber pile supported structures, linear elastic procedures may be used. Alternatively, the nonlinear static procedure may be used to estimate the target displacement demand, Δ_d.*

A simplified single pile model for a typical timber pile supported structure is shown in Figure 31F-4-3. The pile-deck connections may be assumed to be "pinned." The lateral bracing can often be ignored if it is in poor condition. These assumptions shall be used for the analysis, unless a detailed condition assessment and lateral analysis indicate that the existing bracing and connections may provide reliable lateral resistance.

A series of single pile analyses may be sufficient to establish the nonlinear springs required for the pushover analysis.

FIGURE 31F-4-3—SIMPLIFIED SINGLE PILE MODEL OF A TIMBER PILE SUPPORTED STRUCTURE



3104F.2.3.2 Nonlinear static demand procedure. *A nonlinear static procedure shall be used to determine the displacement demand for all concrete and steel structures, with the exception of irregular configurations with high or moderate spill classifications. A linear modal procedure is required for irregular structures with high or moderate spill classifications, and may be used for all other classifications in lieu of the nonlinear static procedure.*

In the nonlinear static demand procedure, deformation demand in each element shall be computed at the target node displacement demand. The analysis shall be conducted in each of the two orthogonal directions and results combined as described in Section 3104F.4.2.

The target displacement demand of the structure, Δ_d, shall be calculated from:

Equation 4-1 $\Delta_d = S_A(T_e^2/4\pi^2)$

where:

T_e *= effective elastic structural period defined in Equation (4-3) or Equation (4-9)*

S_A *= spectral response acceleration corresponding to* T_e

If $T_e < T_0$, where T_0 is the period corresponding to the peak of the acceleration response spectrum, a refined analysis (see Section 3104F.2.3.2.1 or 3104F.2.3.2.2) shall be used to calculate the displacement demand. In the refined analysis, the target node displacement demand may be computed from the Coefficient Method (Section 3104F.2.3.2.1) or the Substitute Structure Method (Section 3104F.2.3.2.2). Both of these methods utilize the pushover curve developed in Section 3104F.2.3.1.

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3104F.2.3.2.1 Coefficient Method. *The Coefficient Method is based on the procedures presented in ASCE/SEI 41 [4.3] and FEMA 440 [4.4].*

The first step in the Coefficient Method requires idealization of the pushover curve to calculate the effective elastic lateral stiffness, k_e, and effective yield strength, F_y, of the structure as shown in Figure 31F-4-4.

The first line segment of the idealized pushover curve shall begin at the origin and have a slope equal to the effective elastic lateral stiffness, k_e. The effective elastic lateral stiffness, k_e, shall be taken as the secant stiffness calculated at the lateral force equal to 60 percent of the effective yield strength, F_y, of the structure. The effective yield strength, F_y, shall not be taken as greater than the maximum lateral force at any point along the pushover curve.

The second line segment shall represent the positive post-yield slope ($\alpha_1 k_e$) determined by a point (F_d, Δ_d) and a point at the intersection with the first line segment such that the area above and below the actual curve area approximately balanced. (F_d, Δ_d) shall be a point on the actual pushover curve at the calculated target displacement, or at the displacement corresponding to the maximum lateral force, whichever is smaller.

The third line segment shall represent the negative post-yield slope ($\alpha_2 k_e$), determined by the point at the end of the positive post-yield slope (F_d, Δ_d) and the point at which the lateral force degrades to 60 percent of the effective yield strength.

The target displacement shall be calculated from:

Equation 4-2 $$\Delta_d = C_1 C_2 S_A \frac{T_e^2}{4\pi^2}$$

where:

S_A *= spectral acceleration of the linear-elastic system at vibration period, which is computed from:*

Equation 4-3 $$T_e = 2\pi \sqrt{\frac{m}{k_e}}$$

where:

m = seismic mass as defined in Section 3104F.2.3

k_e *= effective elastic lateral stiffness from idealized pushover*

C_1 *= modification factor to relate maximum inelastic displacement to displacement calculated for linear elastic response. For period less than 0.2 s, C_1 need not be taken greater than the value at T_e = 0.2 s. For period greater than 1.0 s, C_1 = 1.0. For all other periods:*

Equation 4-4 $$C_1 = 1 + \frac{\mu_{strength} - 1}{a T_e^2}$$

where:

a = Site class factor

= 130 for Site Class A or B,

= 90 for Site Class C, and

= 60 for Site Class D, E or F.

$\mu_{strength}$ *= ratio of elastic strength demand to yield strength coefficient calculated in accordance with Equation (4-6). The Coefficient Method is not applicable where $\mu_{strength}$ exceeds μ_{max} computed from Equation (4-7). $\mu_{strength}$ shall not be taken as less than 1.0.*

C_2 *= modification factor to represent the effects of pinched hysteresis shape, cyclic stiffness degradation and strength deterioration on the maximum displacement response. For periods greater than 0.7s, C_2 = 1.0. For all other periods:*

Equation 4-5 $$C_2 = 1 + \frac{1}{800}\left(\frac{\mu_{strength} - 1}{T_e}\right)^2$$

The strength ratio $\mu_{strength}$ shall be computed from:

Equation 4-6 $$\mu_{strength} = \frac{m S_A}{F_y}$$

where:

F_y *= effective yield strength of the structure in the direction under consideration from the idealized pushover curve.*

For structures with negative post-yield stiffness, the maximum strength ratio μ_{max} shall be computed from:

Equation 4-7 $$\mu_{max} = \frac{\Delta_d}{\Delta_y} + \frac{|\alpha_e|^{-h}}{4}$$

where:

Δ_d *= larger of target displacement or displacement corresponding to the maximum pushover force,*

Δ_y *= displacement at effective yield strength*

Equation 4-8 $h = 1 + 0.15 \ln T_e$

α_e = effective negative post-yield slope ratio which shall be computed from:

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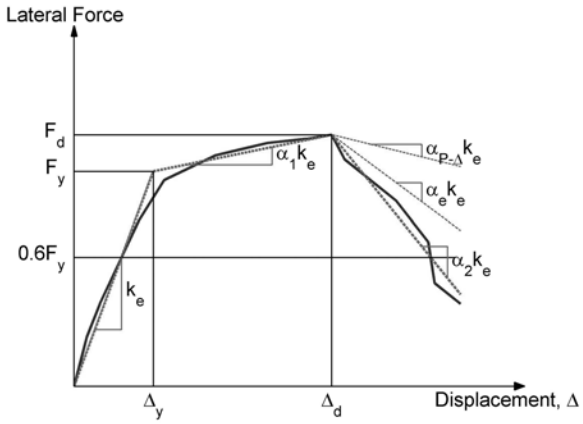
Equation 4-9 $\alpha_e = \alpha_{P\text{-}\Delta} + \lambda(\alpha_2 - \alpha_{P\text{-}\Delta})$

where:

$\alpha_{P\text{-}\Delta}$, and the maximum negative post-elastic stiffness ratio, α_2, are estimated from the idealized force-deformation curve, and λ is a near-field effect factor equal to 0.8 for sites with 1 second spectral value, S_1 greater than or equal to 0.6g and equal to 0.2 for sites with 1 second spectral value, S_1 less than 0.6g.

FIGURE 31F-4-4—IDEALIZATION OF PUSHOVER CURVE (ADAPTED FROM [4.3])



3104F.2.3.2.2 Substitute Structure Method. *The Substitute Structure Method is based on the procedure presented in Priestley et al. [4.5] and ASCE/COPRI 61 [4.2]. This method is summarized below.*

1. *Idealize the pushover curve from nonlinear pushover analysis, as described in Section 3104F.2.3.2.1, and estimate the effective yield strength, F_y, and yield displacement, Δ_y.*
2. *Compute the effective elastic lateral stiffness, k_e, as the effective yield strength, F_y, divided by the yield displacement, Δ_y.*
3. *Compute the structural period in the direction under consideration from:*

Equation 4-10 $T_e = 2\pi\sqrt{\frac{m}{k_e}}$

where:

m = seismic mass as defined in Section 3104F.2.3

k_e = effective elastic lateral stiffness in direction under consideration

4. *Determine target displacement, Δ_d, of the effective linear elastic system from:*

Equation 4-11 $\Delta_d = S_A\frac{T_e^2}{4\pi^2}$

where:

S_A = the 5 percent damped spectral displace-ment corresponding to the linear elastic structural period, T_e

Select the initial estimate of the displacement demand as $\Delta_{d,i} = \Delta_d$.

5. *The ductility level, $\mu_{\Delta i}$, is found from $\Delta_{d,i}/\Delta_y$. Use the appropriate relationship between ductility and damping, for the component undergoing inelastic deformation, to estimate the effective structural damping, $\xi_{eff,i}$. In lieu of more detailed analysis, Equation (4-12) may be used for concrete and steel piles connected to the deck through dowels embedded in the concrete. Note that the idealized pushover curves in Figure 31F-4-4 shall be utilized in Figure 31F-4-5, which illustrates the iterative procedure.*

Equation 4-12 $\xi_{eff,i} = 0.05 + \frac{1}{\pi}\left(1 - \frac{1-\alpha_1}{\sqrt{\mu_{\Delta,i}}} - \alpha_1\sqrt{\mu_{\Delta,i}}\right)$

where:

α_1 = ratio of second slope over elastic slope (see Figures 31F-4-4 and 31F-4-5)

Equation (4-12) for effective damping was developed by Kowalsky et al. [4.6] for the Takeda hysteresis model of system's force-displacement relationship.

6. *Compute the force, $F_{d,i}$, on the force-deformation relationship associated with the estimated displacement, $\Delta_{d,i}$ (see Figure 31F-4-5).*

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7. *Compute the effective stiffness, $k_{eff,i}$, as the secant stiffness from:*

   Equation 4-13 $$k_{eff,i} = \frac{F_{d,i}}{\Delta_{d,i}}$$

8. *Compute the effective period, $T_{eff,i}$, from:*

   Equation 4-14 $$T_{eff,i} = 2\pi\sqrt{\frac{m}{k_{eff,i}}}$$

   where:

   m = seismic mass as defined in Section 3104F.2.3

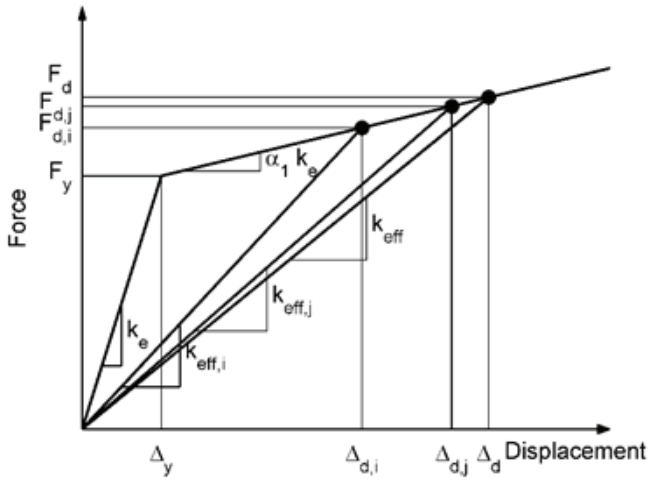
9. *For the effective structural period, $T_{eff,i}$, and the effective structural damping, $\xi_{eff,i}$, compute the spectral acceleration $S_A(T_{eff,i}, \xi_{eff,i})$ from an appropriately damped design acceleration response spectrum.*

10. *Compute the new estimate of the displacement, $\Delta_{d,j}$, from:*

    Equation 4-15 $$\Delta_{d,j} = \frac{T_{eff,i}^2}{4\pi^2} S_A(T_{eff,i}, \xi_{eff,i})$$

11. *Repeat steps 5 to 10 with $\Delta_{d,i} = \Delta_{d,j}$ until displacement, $\Delta_{d,j}$, computed in step 10 is sufficiently close to the starting displacement, $\Delta_{d,i}$, in step 5 (Figure 31F-4-5).*

FIGURE 31F-4-5—EFFECTIVE STIFFNESS FOR SUBSTITUTE STRUCTURE METHOD



3104F.2.3.3 Linear modal demand procedure. *For irregular concrete/steel structures with moderate or high spill classifications, a linear modal analysis is required to predict the global displacement demands. A 3-D linear elastic response analysis shall be used, with effective moment of inertia applied to components to establish lateral displacement demands, to compute displacement components of an element along each axis of the system.*

Sufficient modes shall be included in the analysis such that 90 percent of the participating mass is captured in each of the principal horizontal directions for the structure. For modal combinations, the Complete Quadratic Combination rule shall be used. Multidirectional excitation shall be accounted for in accordance with Section 3104F.4.2.

The lateral stiffness of the linear elastic response model shall be based on the initial stiffness of the nonlinear pushover curve as shown in Figure 31F-4-6 (also see Section 3106F.9). The p-y springs shall be adjusted based on the secant method approach. Most of the p-y springs will typically be based on their initial stiffness; no iteration is required.

If the fundamental period is $T < T_0$, where T_0 is the period corresponding to the peak of the acceleration response spectrum, the displacement demand from the linear modal analysis shall be amplified to account for nonlinear system behavior by an amplification factor. The amplification factor shall be equal to either $C_1 \times C_2$ per Section 3104F.2.3.2.1, or the ratio of the final target displacement and the initial elastic displacement of Equation (4-11) per Section 3104F.2.3.2.2.

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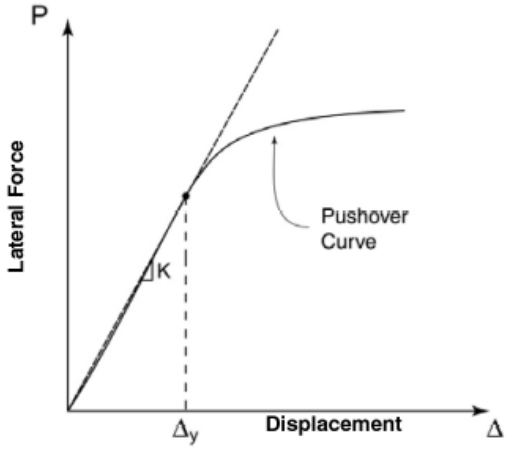
FIGURE 31F-4-6—STIFFNESS FOR LINEAR MODAL ANALYSIS



3104F.2.3.4 Nonlinear dynamic analysis. *Nonlinear dynamic time history analysis is optional, and if performed, a peer review is required (see Section 3101F.8.2). Multiple acceleration records shall be used, as explained in Section 3103F.4.2.10. The following assumptions may be made:*

1. *Equivalent "super piles" can represent groups of piles.*
2. *If the deck has sufficient rigidity (both in-plane and out-of-plane) to justify its approximation as a rigid element, a 2-D plan simulation may be adequate.*

A time-history analysis should always be compared with a simplified approach to ensure that results are reasonable. Displacements calculated from the nonlinear time history analyses may be used directly in design, but shall not be less than 80 percent of the values obtained from Section 3104F.2.3.2.

3104F.2.3.5 Alternative procedures. *Alternative lateral-force procedures using rational analyses based on well-established principles of mechanics may be used in lieu of those prescribed in these provisions. As per Section 3101F.8.2, peer review is required.*

3104F.3 New MOTs. *The analysis and design requirements described in Section 3104F.2 shall also apply to new MOTs. However, new MOTs shall comply with the seismic performance criteria for high spill classification, as defined in Table 31F-4-1. Additional requirements are as follows:*

1. *Site-specific response spectra analysis (see Section 3103F.4.2.3).*
2. *Soil parameters based on site-specific and new borings (see Section 3106F.2.2).*

3104F.4 General analysis and design requirements.

3104F.4.1 Load combinations. *Earthquake loads shall be used in the load combinations described in Section 3103F.8.*

3104F.4.2 Combination of orthogonal seismic effects. *The design displacement demand at an element, δ_d, shall be calculated by combining the longitudinal, δ_x, and transverse, δ_y, displacements in the horizontal plane (Figure 31F-4-7):*

Equation 4-16 $\delta_d = \sqrt{\delta_x^2 + \delta_y^2}$

where:

Equation 4-17 $\delta_x = \delta_{xy} + 0.3\delta_{xx}$

and

Equation 4-18 $\delta_y = 0.3\delta_{yx} + \delta_{yy}$

OR

Equation 4-19 $\delta_y = \delta_{yx} + 0.3\delta_{yy}$

and

Equation 4-20 $\delta_x = 0.3\delta_{xy} + \delta_{xx}$

whichever results in the greater design displacement demand.

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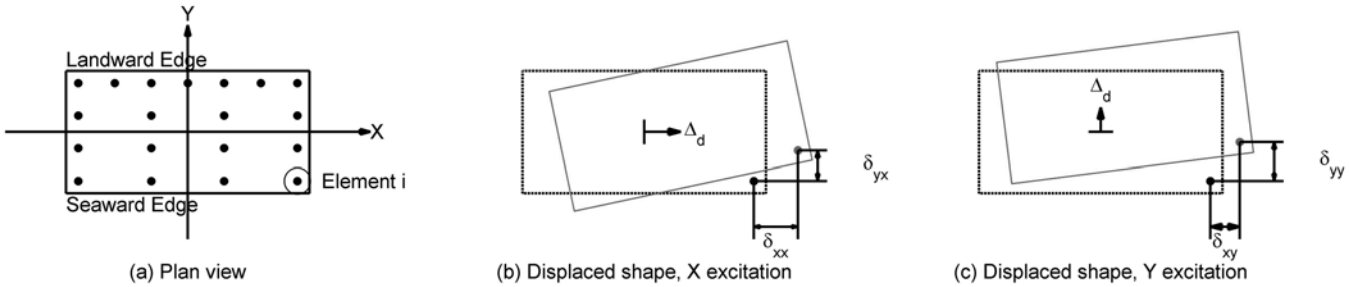
FIGURE 31F-4-7—PLAN VIEW OF WHARF SEGMENT UNDER X AND Y SEISMIC EXCITATIONS



3104F.4.3 P-Δ Effects. *The P-Δ effect (i.e., the additional moment induced by the total vertical load multiplied by the lateral deck deflection) shall be considered unless the following relationship is satisfied (see Figure 31F-4-8):*

Equation 4-21 $$\frac{V}{W} \geq 4\frac{\Delta_d}{H}$$

where:

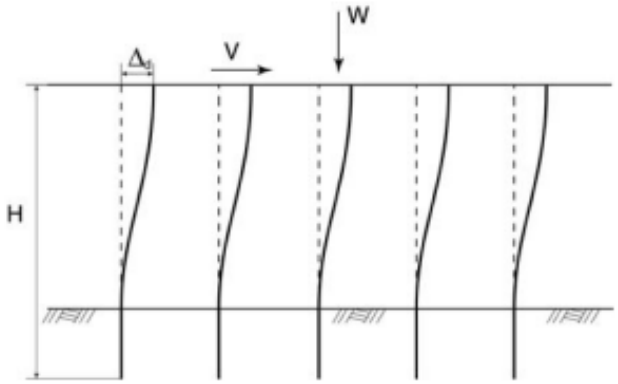
V = base shear strength of the structure obtained from a plastic analysis

W = dead load of the frame

Δ_d = displacement demand

H = distance from the location of maximum in-ground moment to center of gravity of the deck

FIGURE 31F-4-8—P-Δ EFFECT



For wharf structures where the lateral displacement is limited by almost fully embedded piles, P-Δ effects may be ignored; however, the individual stability of the piles shall be checked in accordance with Section 3107F.2.5.2.

If the landside batter piles are allowed to fail in a Level 2 evaluation, the remaining portion of the wharf shall be checked for P-Δ effects.

3104F.4.4 Expansion joints. *The effect of expansion joints shall be considered in the seismic analysis.*

3104F.4.5 Shear key forces. *Shear force across shear keys connecting adjacent wharf segments, V_{sk}, (approximate upper bound to the shear key force [4.7]) shall be calculated as follows:*

Equation 4-22 $$V_{sk} = 1.5(e/L_l)V_{\Delta T}$$

where:

$V_{\Delta T}$ = total segment lateral force found from a push-over analysis

L_l = segment length

e = eccentricity between the center of rigidity and the center of mass

3104F.4.6 Connections. *For an existing wharf, the deteriorated conditions at the junction between the pile top and pile cap shall be considered in evaluating the moment capacity. Connection detail between the vertical pile and pile cap shall be evaluated to determine whether full or partial moment capacity can be developed under seismic action.*

For new MOTs, the connection details shall develop the full moment capacities.

The modeling shall simulate the actual moment capacity (full or partial) of the joint in accordance with Section 3107F.2.7.

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3104F.4.7 Batter piles. *Batter piles primarily respond to earthquakes by developing large axial compression or tension forces. Bending moments are generally of secondary importance. Failure in compression may be dictated by the deck-pile connection (most common type), material compression, buckling or by excessive local shear in deck members adjacent to the batter pile. Failure in tension may be dictated by connection strength or by pile pull out (p. 3-83 of Ferritto et al. [4.7]).*

When the controlling failure scenario is reached and the batter pile fails, the computer model shall be adjusted to consist of only the vertical pile acting either as a full or partial moment frame based on the connection details between the pile top and pile cap. The remaining displacement capacity, involving vertical piles, before the secondary failure stage develops, shall then be established (see Section 3107F.2.8).

Axial p-z curves shall be modeled. In compression, displacement capacity should consider the effect of the reduction in pile modulus of elasticity at high loads and the increase in effective length for friction piles. This procedure allows the pile to deform axially before reaching ultimate loads, thereby increasing the displacement ductility [4.7].

Horizontal nonlinear p-y springs are only applied to batter piles with significant embedment, such as for landside batter piles in a wharf structure. Moment fixity can be assumed for batter piles that extend well above the ground such as waterside batter piles in a wharf structure or batter piles in a pier type structure.

3104F.5 Nonstructural components, nonbuilding structures and building structures. *Nonstructural components, nonbuilding structures and building structures at MOTs shall be assessed for Level 2 seismic performance (see Section 3104F.2.1). Consideration shall be given to the adequacy and condition of supports and attachments (or anchorage), strength, flexibility, relative displacement, P-delta effects, and seismically-induced interaction with other components and structures.*

3104F.5.1 General. *Nonstructural components are mechanical, electrical and architectural components (such as piping/pipelines, loading arms, lifting equipment (winches and cranes), spill prevention equipment, pumps, instrumentation and storage cabinets, and lighting fixtures) that may be required to resist the effects of earthquake.*

Nonbuilding structures (such as gangways, hose towers and racks) are self-supporting structures that carry gravity loads and may be required to resist the effects of earthquake, but are not building structures (such as control rooms). For building structures, see Section 3104F.5.6.

Critical systems are nonstructural components, nonbuilding structures or building structures that shall remain operational or those whose failure could impair emergency operations following an earthquake, to prevent major oil spills and to protect public health, safety and the environment. A seismic assessment of the survivability and continued operation (related to personnel safety, oil spill prevention or response) during a Level 2 earthquake (see Table 31F-4-1) shall be performed for critical systems, including but not limited to, fire protection, emergency shutdown and electrical power systems.

3104F.5.2 Seismic assessment. *For existing (E) nonstructural components, nonbuilding structures and building structures and their supports and attachments, seismic assessment shall be performed in accordance with CalARP [4.8] or ASCE Guidelines [4.9], except for piping/pipelines which shall be evaluated per Section 3109F. If seismic evaluation and/or strengthening are required, it shall be performed in accordance with Section 3104F.5.2.1.*

For new (N) nonstructural components, nonbuilding structures and building structures and their supports and attachments, seismic evaluation and design shall be performed in accordance with Section 3104F.5.2.1, except for piping/pipelines which shall be evaluated per Section 3109F.

3104F.5.2.1 Seismic evaluation, strengthening and design. *For evaluation, strengthening and design of nonstructural components, nonbuilding structures and building structures, seismic forces (demands) shall be obtained from Section 3104F.5. The seismic adequacy of nonstructural components shall be demonstrated as specified in ASCE/SEI 7 [4.1]. Structures shall be analyzed in accordance with Section 3107F.5. Supports and attachments shall be assessed in accordance with Sections 3107F.7.*

3104F.5.3 Contribution to global response of MOT structures. *Nonstructural components, nonbuilding structures and building structures permanently attached to MOT structures, including, but not limited to, pipelines, loading arms, hose towers/racks, raised platforms, control rooms and vapor control equipment, may affect the global structural response. In such cases, the seismic characteristics (mass and/or stiffness) of the nonstructural components, nonbuilding structures and building structures shall be considered in computing global seismic response of the MOT structures. If the seismic response of nonstructural components is determined to be out of phase (e.g. pipelines) with the global structural response, then the mass contribution can be neglected in the seismic structural analysis.*

3104F.5.4 Nonstructural components and nonbuilding structures permanently attached to MOT structures. *This section covers nonstructural components and nonbuilding structures having a significant mass and/or importance to the operability and safety of the MOT, and that are permanently attached to MOT structures (e.g., wharves, trestles, dolphins). The weight of nonstructural components and nonbuilding structures shall be included in the dead load of the structure per Section 3103F.2.*

Computation of seismic effects shall consider:

1. *Amplification of acceleration from ground to location of attachment of the nonstructural component or nonbuilding structure to the deck due to flexibility of the MOT structure, and*
2. *Amplification of acceleration due to flexibility of the nonstructural component or nonbuilding structure.*

The following are not covered in this section and shall be assessed using rational approach that includes consideration of strength, stiffness, ductility and seismic interaction with all other connected components and with the supporting structures or systems, subject to Division approval:

1. *Nonstructural component supported by other nonstructural system permanently attached to MOT structure;*

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2. *Nonstructural component or nonbuilding structure supported by other structure permanently attached to MOT structure;*
3. *Nonstructural component or nonbuilding structure attached to multiple MOT structures;*
4. *Nonstructural component or nonbuilding structure attached to structure and ground.*

3104F.5.4.1 Seismic loads. *This section specifies the procedure to compute seismic loads on nonstructural components and nonbuilding structures permanently attached to a MOT structure.*

The following nonstructural components are exempt from the requirements of this section:

1. *Temporary or movable equipment unless part of a critical system (Section 3104F.5.1);*
2. *Mechanical and electrical components that are attached to the MOT structure and have flexible connections to associated piping and conduit; and either:*
   (a) *The component weighs 400 lb or less, the center of mass is located 4 ft or less above the MOT deck, and the component Importance Factor, I_p is equal to 1.0; or*
   (b) *The component weighs 20 lb or less, or in the case of a distributed system, 5 lb/ft or less.*

3104F.5.4.1.1 Simplified Procedure. *The Simplified Procedure may be used to estimate seismic loads on nonstructural components and nonbuilding structures permanently attached to a MOT structure. The Simplified Procedure shall not be used if any of the following apply:*

1. *Mass of the nonstructural component or nonbuilding structure exceeds 25 percent of the combined mass of the MOT structure plus nonstructural component or nonbuilding structure;*
2. *Multiple nonstructural components or nonbuilding structures of similar type (or natural period) when their combined mass exceeds 25 percent of the total mass of the MOT structure plus nonstructural components or nonbuilding structures;*
3. *Concrete/Steel MOT structure with irregular configuration (Section 3104F.1.3 and Table 31F-4-2) and high or medium spill exposure classification.*

The horizontal seismic force, F_p, shall be computed as follows [4.10]:

Equation 4-23
$$F_p = \frac{1.2 S_{xs} a_p I_p W_p}{R_p}$$

$$0.3 S_{xs} I_p W_p \le F_p \le 1.6 S_{xs} I_p W_p$$

where:

S_{xs} = *spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5*

a_p = *amplification factor for nonstructural component or nonbuilding structure (Table 31F-4-3)*

I_p = *importance factor for nonstructural component or nonbuilding structure (Table 31F-4-4)*

W_p = *weight of the nonstructural component or nonbuilding structure*

R_p = *response modification factor for nonstructural component or nonbuilding structure (Table 31F-4-5)*

Alternatively, when dynamic properties of the MOT structure are available, the horizontal seismic force, F_p, may be computed from [4.10]:

Equation 4-24
$$F_p = \frac{a_p S_A I_p A_x W_p}{R_p}$$

$$0.3 S_{xs} I_p W_p \le F_p \le 1.6 S_{xs} I_p W_p$$

where:

S_A = *spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5, at the period equal to the elastic fundamental period of the MOT structure, T, in direction under consideration*

A_x = *torsional amplification factor given by:*

Equation 4-25
$$A_x = \left(\frac{\Delta_m}{1.2\Delta_{avg}}\right)^2$$

$$1 \le A_x \le 3$$

where:

Δ_m = *maximum displacement at one end of the MOT structure transverse to an axis*

Δ_{avg} = *average of the displacements at the extreme points of the MOT structure (see Figure 31F-4-1)*

The horizontal seismic force, F_p, in the direction under consideration shall be applied at the center of gravity and distributed relative to the mass distribution of the nonstructural component or nonbuilding structure.

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The horizontal seismic force, F_p, shall be applied independently in at least two orthogonal horizontal directions in combination with service or operating loads associated with the nonstructural component or nonbuilding structure, as appropriate. For vertically cantilevered systems, however, F_p shall be assumed to act in any horizontal direction.

The concurrent vertical seismic force, F_v, shall be applied at the center of gravity and distributed relative to the mass distribution of the nonstructural component or nonbuilding structure, as follows:

Equation 4-26 $F_v = \pm 0.2 S_{xs} W_p$

TABLE 31F-4-3—AMPLIFICATION FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES	
COMPONENT OR STRUCTURE	**a_p[1, 2]**
Rigid components or structures (period less than 0.06 seconds)	*1.0*
Rigidly attached components or structures	*1.0*
Flexible components or structures (period longer than 0.06 seconds)	*2.5*
Flexibly attached components or structures	*2.5*

1. *A lower value shall not be used unless justified by detailed dynamic analysis, and shall in no case be less than 1.0.*
2. *If the fundamental period of the MOT structure, T, and the period of the flexible nonstructural component or nonbuilding structure, T_p, is known, a_p may be estimated from Figure 31F-4-9.*

FIGURE 31F-4-9—AMPLIFICATION FACTOR, a_p [4.10]

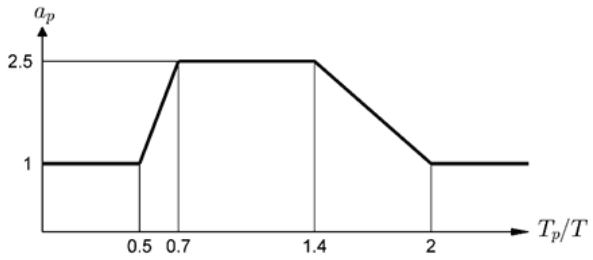

TABLE 31F-4-4—IMPORTANCE FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES	
COMPONENT OR STRUCTURE	**I_p**
Critical[1, 2]	*1.5*
Other	*1.0*

1. *See Section 3104F.5.1 for definition of critical system.*
2. *A lower value may be utilized, subject to Division approval.*

TABLE 31F-4-5—RESPONSE MODIFICATION FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES	
COMPONENT OR STRUCTURE	**R_p[1]**
Loading arms	*3.0*
Piping/pipelines (welded)	*12.0*
Pining/pipelines (threaded or flanged)	*6.0*
Pumps	*2.5*
Skids	*2.5*
Tanks and totes	*2.5*
Light fixtures (or luminaries)	*1.5*
Electrical conduits and cable trays	*6.0*
Mooring hardware	*2.5*
Velocity monitoring equipment	*2.5*
Instrumentation or storage cabinets	*6.0*
Cranes	*2.5*
Gangway (column systems)	*3.0*

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TABLE 31F-4-5—RESPONSE MODIFICATION FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES—continued	
COMPONENT OR STRUCTURE	**R_p [1]**
Gangways (truss systems)	Use R_p from frame systems
Hose towers and racks	Use R_p from frame systems
Frame systems:	
Steel special concentrically braced frames	6.0
Steel ordinary concentrically braced frames	3.5
Steel special moment frames	8.0
Steel intermediate moment frames	4.5
Steel ordinary moment frames	3.5
Lightframe wood sheathed with wood structural panels	6.5
Lightframe cold-formed steel sheathed with wood structural panels	6.5
Lightframe walls with shear panels of other materials	2.0
Other	Subject to Division approval
1. A higher value may be utilized, subject to Division approval.	

3104F.5.4.1.2 Linear modal demand procedure. *The linear modal demand procedure (Section 3104F.2.3.3) may always be used and shall be used to estimate seismic forces when the Simplified Procedure (Section 3104F.5.4.1.1) is not permitted. The MOT structure and nonstructural components and/or nonbuilding structures shall be modeled explicitly. The seismic forces obtained from the linear modal demand procedure shall be adjusted for appropriate importance factors and response modification factors as specified in Table 31F-4-4 and Table 31F-4-5.*

3104F.5.5 Nonstructural components and nonbuilding structures permanently attached to the ground. *The seismic load shall be computed using the procedures in ASCE/SEI 7 [4.1], except that Level 2 design earthquake motion parameters defined in Section 3103F.4 shall be used in lieu of those specified in ASCE/SEI 7 [4.1].*

3104F.5.6 Building structures. *For buildings permanently attached to MOT structure, Section 3104F.5.4.1 shall be used to compute seismic loads. Computation of seismic effects shall consider:*

1. *Amplification of acceleration from ground to location of attachment of the building to the deck due to flexibility of the MOT structure, and*
2. *Amplification of acceleration due to flexibility of the building.*

For buildings permanently attached to the ground, seismic loads shall be computed using the procedures in ASCE/SEI 7 [4.1], as amended by the local enforcing agency requirements, subject to Division approval.

3104F.6 Symbols.

a = Site class factor

a_p = Amplification factor for nonstructural component or nonbuilding structure

A_x = Torsional amplification factor

C_1 = Modification factor to relate expected maximum inelastic displacement to displacement calculated for linear elastic response

C_2 = Modification factor to represent the effects of pinched hysteresis shape, cyclic stiffness degradation and strength deterioration on the maximum displacement response

e = Eccentricity between center of mass and center of rigidity

$F_{d,i}$ = Force at step i of iteration

$F_{d,j}$ = Force at step j of iteration

F_p = Horizontal seismic force on nonstructural component, nonbuilding structure or building structure supported on MOT

F_v = Vertical seismic force on nonstructural component, nonbuilding structure or building structure supported on MOT

F_y = Effective yield strength

H = Distance from maximum in-ground moment to center of gravity of the deck

I_p = Importance factor for nonstructural component or nonbuilding structure

k_e = Effective elastic lateral stiffness

$k_{eff,i}$ = Effective secant lateral stiffness at step i of iteration

$k_{eff,j}$ = Effective secant lateral stiffness at step j of iteration

L_l = Longitudinal length between wharf expansion joints

m = Seismic mass

R_p = Response modification factor for nonstructural component or nonbuilding structure

S_A = Spectral response acceleration at T

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S_{xs} = Spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5

S_1 = 1-second spectral response acceleration

T = Fundamental period of the elastic structure

T_e = Effective elastic structural period

$T_{eff,\,i}$ = Effective structural period at step i of iteration

T_p = Period of flexible nonstructural component or nonbuilding structure

T_0 = Period at peak of the acceleration response spectrum

V = Base shear strength of the structure obtained from a plastic analysis

V_{sk} = Shear force across shear keys

$V_{\Delta T}$ = Total segment lateral force

W = Dead load of the frame

W_p = Weight of the nonstructural component or nonbuilding structure

Δ_d = Target displacement demand

$\Delta_{d,\,i}$ = Target displacement demand at step i of iteration

$\Delta_{d,\,j}$ = Target displacement demand at step j of iteration

α_1 = Positive post-yield slope ratio equal to positive post-yield stiffness divided by the effective stiffness

α_2 = Negative post-yield slope ratio equal to negative post-yield stiffness divided by the effective stiffness

α_e = Effective negative post-yield slope ratio equal to effective post-yield negative stiffness divided by the effective stiffness

$\alpha_{P\text{-}\Delta}$ = Negative slope ratio caused by P-Δ effects

Δ_{avg} = Average of displacements, Δ_1 and Δ_2, at ends of the MOT transverse to an axis

Δ_d = Target displacement

Δ_m = Maximum of displacements, Δ_1 and Δ_2, at ends of the MOT transverse to an axis

Δ_y = Displacement at yield strength

Δ_1, Δ_2 = Displacement at ends of the MOT transverse to an axis

δ_d = Design displacement demand at an element

δ_x = Displacement of an element in X direction

δ_y = Displacement of an element in Y direction

δ_{xx} = X displacement under X direction excitation

δ_{xy} = X displacement under Y direction excitation

δ_{yx} = Y displacement under X direction excitation

δ_{yy} = Y displacement under Y direction excitation

λ = Near-field effect factor

μ_{max} = Maximum strength ratio

$\mu_{strength}$ = Ratio of elastic strength demand to yield strength

$\mu_{\Delta,\,i}$ = Initial ductility level

$\xi_{eff,i}$ = Effective structural damping at step i of iteration

3104F.7 References.

[4.1] American Society of Civil Engineers (ASCE), 2016, ASCE/SEI 7-16 (ASCE/SEI 7), "Minimum Design Loads and Associates Criteria for Buildings and Other Structures," Reston, VA.

[4.2] American Society of Civil Engineers (ASCE), 2014, ASCE/COPRI 61-14 (ASCE/COPRI 61), "Seismic Design of Piers and Wharves," Reston, VA.

[4.3] American Society of Civil Engineers (ASCE), 2017, ASCE/SEI 41-17 (ASCE/SEI 41), "Seismic Evaluation and Retrofit of Existing Buildings," Reston, VA.

[4.4] Federal Emergency Management Agency (FEMA), June 2005, FEMA 440, "Improvement of Nonlinear Static Seismic Analysis Procedures," Redwood City, CA.

[4.5] Priestley, M.J.N., Seible, F., Calvi, G.M., 1996, "Seismic Design and Retrofit of Bridges," John Wiley & Sons, Inc., New York.

[4.6] Kowalsky, M.J., Priestley, M.J.N, MacRae, G.A., 1994, "Displacement-Based Design – A Methodology for Seismic Design Applied to Single Degree of Freedom Reinforced Concrete Structures," Report No. SSRP – 94/16, University of California, San Diego.

[4.7] Ferritto, J., Dickenson, S., Priestley N., Werner, S., Taylor, C., Burke, D., Seelig, W., and Kelly, S., 1999, "Seismic Criteria for California Marine Oil Terminals," Vol. 1 and Vol. 2, Technical Report TR-2103-SHR, Naval Facilities Engineering Service Center, Port Hueneme, CA.

[4.8] CalARP Program Seismic Guidance Committee, December 2013, "Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments," Sacramento, CA.

[4.9] American Society of Civil Engineers, 2011, "Guidelines for Seismic Evaluation and Design of Petrochemical Facilities," 2nd ed., New York.

[4.10] Goel, R. K., 2017, "Estimating Seismic Forces in Ancillary Components and Nonbuilding Structures Supported on Piers, Wharves, and Marine Oil Terminals," Earthquake Spectra, https://doi.org/10.1193/041017EQS068M.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 5

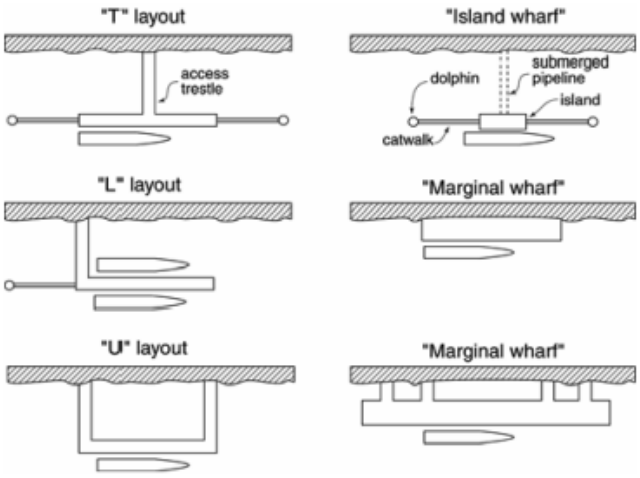
SECTION 3105F—MOORING AND BERTHING ANALYSIS AND DESIGN

3105F.1 General.

3105F.1.1 Purpose. *This section establishes minimum standards for safe mooring and berthing of vessels at MOTs.*

3105F.1.2 Applicability. *This section applies to onshore MOTs; Figure 31F-5-1 shows typical pier and wharf configurations.*

FIGURE 31F-5-1—TYPICAL PIER AND WHARF CONFIGURATIONS



3105F.1.3 Mooring/berthing requirements. *Multiple berth MOTs shall use the same environmental input conditions for each berth unless it can be demonstrated that there are significant differences.*

MOTs shall have the following equipment in operation:

1. *An anemometer (N/E).*
2. *A current meter in high velocity current (>1.5 knots) areas (N/E).*
3. *Remote reading tension load devices in high velocity current (>1.5 knots) areas and/or with passing vessel effects for new MOTs.*
4. *Mooring hardware in accordance with Section 3105F.8 (N/E).*

Berthing systems shall be in accordance with Section 3105F.4 (N/E).

Monitoring systems and instrumentation shall be implemented considering the parameters in Section 3102F.3.6.1, and shall be installed, maintained and calibrated in accordance with Section 3111F.9.3.

3105F.1.4 New MOTs. *Quick release hooks are required at all new MOTs, except for spring line fittings. Quick release hooks shall be sized in accordance with Section 3105F.8 To avoid accidental release, the freeing mechanism shall be activated by a two-step process. Quick release hooks shall be insulated electrically from the mooring structure, and shall be supported so as not to contact the deck.*

Section 3105F.5 and the OCIMF guidelines [5.4] shall be used in designing the mooring layout.

3105F.1.5 Analysis and design of mooring components. *The existing condition of the MOT shall be used in the mooring analysis (see Section 3102F). Structural characteristics of the MOT, including type and configuration of mooring fittings such as bollards, bitts, hooks and capstans and material properties and condition, shall be determined in accordance with Sections 3107F.7 and 3105F.8.*

The analysis and design of mooring components shall be based on the loading combinations and safety factors defined in Sections 3103F.8, 3105F.7 and 3105F.8, and in accordance with ACI 318 [5.1], AISC 325 [5.2] and ANSI/AWC NDS [5.3], as applicable.

3105F.2 Mooring analyses. *A mooring analysis shall be performed for each berthing system, to justify the safe mooring of the various vessels at the MOT. Review of vessels calling at the MOT shall be performed to identify representative vessel size ranges and mooring configurations. Vessels analyzed shall be representative of the upper bound of each vessel size range defined by DWT capacity (see Section 3101F.6). The Terminal Operating Limits (TOLs) shall be generated based on the mooring analyses (see Section 3102F.3.6.1 and Figure 31F-2-1).*

The forces acting on a moored vessel shall be determined in accordance with Section 3103F.5. Mooring line and breasting load combinations shall be in accordance with Section 3103F.8.

Two procedures, manual and numerical, are available for performing mooring analyses. These procedures shall conform to either the OCIMF (MEG 3) [5.4] or UFC 4-159-03 [5.5]. The manual procedure (Section 3105F.2.1) may be used for barges. In order to simplify the analysis for barges (or other small vessels), they may be considered to be solid free-standing walls (Chapter 29 of ASCE/SEI 7 [5.6]). This will eliminate the need to perform a computer assisted mooring analysis.

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A new mooring assessment shall be performed when conditions change, such as any modification in the mooring configuration, vessel size or new information indicating greater wind, current or other environmental loads.

The most severe combination of the environmental loads and limiting conditions shall be justified based on site-specific evaluation, and considered in the mooring analyses. At a minimum, the following shall be considered and documented:

1. *Two current directions (maximum ebb and flood; See Section 3103F.5.3)*
2. *Two tide levels (highest high and lowest low)*
3. *Two vessel loading conditions (ballast and maximum draft at the terminal)*
4. *Eight wind directions (45 degree increments)*
5. *Vessel motion limits (as applicable)*
6. *Fender properties*
7. *Mooring hardware capacities*
8. *Minimum mooring line properties (such as MBL of the weakest line permitted for vessel size range)*
9. *Passing vessel forces*

In general, vessels shall remain in contact with the breasting or fendering system. Vessel motion (sway) of up to 2 feet off the breasting structure may be allowed under the most severe environmental loads, unless greater movement can be justified by an appropriate mooring analysis that accounts for potential dynamic effects. The allowable movement shall be consistent with mooring analysis results, indicating that forces in the mooring lines and their supports are within the allowable safety factors. Also, a check shall be made as to whether the movement is within the limitations of the cargo transfer equipment.

The mooring analyses outputs define the wind load and other limitations.

Upon completion of the mooring analyses, the following shall be checked, as applicable:

1. *The fender system compression/deflection performance.*
2. *Anchorage capacity of each mooring hardware component.*
3. *Capacity of supporting structure(s) exceed each mooring line demand.*
4. *Maximum allowable capacities for mooring lines.*
5. *Vessel motion does not exceed the maximum allowable extension limits of the loading arms and/or hoses.*

3105F.2.1 Manual procedure. *Simplified calculations may be used to determine the mooring forces for barges with Favorable Site Conditions (see Table 31F-3-8) and no passing vessel effects (see Section 3105F.3.2), except if any of the following conditions exist (Figures 31F-5-2 and 31F-5-3).*

1. *Mooring layout is significantly asymmetrical*
2. *Horizontal mooring line angles (α) on bow and stern exceed 45 degrees*
3. *Horizontal breast mooring line angles exceed 15 normal to the hull*
4. *Horizontal spring mooring line angles exceed 10 degrees from a line parallel to the hull*
5. *Vertical mooring line angles (θ) exceed 25 degrees*
6. *Mooring lines for lateral loads not grouped at bow and stern*

When the forces have been determined and the distance between the bow and stern mooring points is known, the yaw moment can be resolved into lateral loads at the bow and stern. The total environmental loads on a moored vessel are comprised of the lateral load at the vessel bow, the lateral load at the vessel stern and the longitudinal load. Line pretension loads must be added.

Four load cases shall be considered:

1. *Entire load is taken by mooring lines*
2. *Entire load is taken by breasting structures*
3. *Load is taken by combination of mooring lines and breasting structures*
4. *Longitudinal load is taken only by spring lines*

FIGURE 31F-5-2—HORIZONTAL LINE ANGLES [5.4]

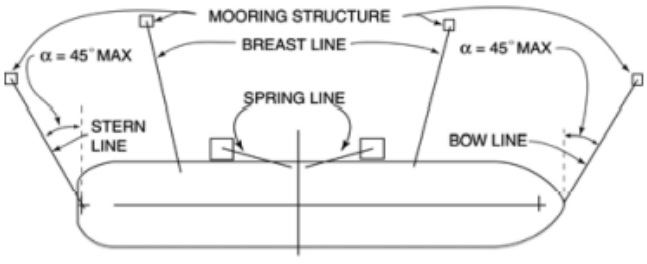

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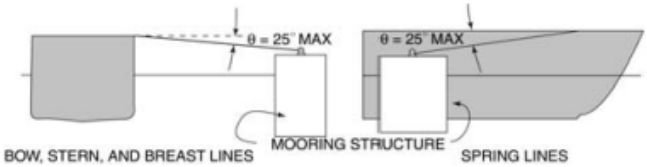
FIGURE 31F-5-3—VERTICAL LINE ANGLES [5.4]



3105F.2.2 Numerical procedure. *A numerical procedure is required to obtain mooring forces for MOTs that cannot use manual procedure. Computer program(s) shall be based on mooring analysis procedures that consider the characteristics of the mooring system, calculate the environmental loads and provide resulting mooring line forces and vessel motions (surge and sway).*

3105F.3 Wave, passing vessel, seiche and tsunami.

3105F.3.1 Wind waves. *MOTs are generally located in sheltered waters such that typical wind waves can be assumed not to affect the moored vessel if the significant wave period, T_s, is less than 4 seconds. However, if the period is equal to or greater than 4 seconds, then a simplified dynamic analysis (See Section 3103F.5.4) is required. The wave period shall be established based on a 1-year significant wave height, H_s. For MOTs within a harbor basin, the wave period shall be based on the locally generated waves with relatively short fetch.*

3105F.3.2 Passing vessels. *These forces generated by passing vessels are due to pressure gradients associated with the flow pattern. These pressure gradients cause the moored vessel to sway, surge and yaw, thus imposing forces on the mooring lines.*

Passing vessel analysis shall be conducted when all of the following conditions exist (See Figure 31F-5-4):

1. *Passing vessel size is greater than 25,000 DWT.*
2. *Distance L is 500 feet or less*
3. *Vessel speed V is greater than V_{crit}*

where:

Equation 5-1 $$V_{crit} = 1.5 + \frac{L - 2B}{500 - 2B}\ 4.5(knots)$$

Exception: *If L ≤ 2B, passing vessel loads shall be considered.*

L and B are shown in Figure 31F-5-4, in units of feet. V is defined as the speed of vessel over land minus the current velocity, when traveling with the current, or the speed of vessel over land plus the current velocity, when traveling against the current.

When such conditions (1, 2 and 3 above) exist, the surge and sway forces and the yaw moment acting on the moored vessel shall, as a minimum, be established in accordance with Section 3103F.5.5 or by dynamic analysis.

For MOTs located in ports, the passing distance, L, may be established based on channel width and vessel traffic patterns. The guidelines established in Figure 5-17 of UFC 4-150-06 [5.7] for interior channels may be used. The "vertical bank" in Figure 5-17 of UFC 4-150-06 [5.7] shall be replaced by the side of the moored vessel when establishing the distance, "L."

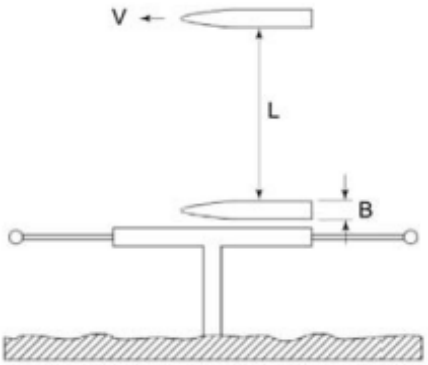
For MOTs, not located within a port, the distance, "L," must be determined from observed traffic patterns.

The following passing vessel positions shall be investigated:

1. *Passing vessel is centered on the moored ship. This position produces maximum sway force.*
2. *The midship of the passing vessel is fore or aft of the centerline of the moored ship by a distance of 0.40 times the length of the moored ship. This position is assumed to produce maximum surge force and yaw moment at the same time.*

The mooring loads due to a passing vessel shall be added to the mooring loads due to wind and current.

FIGURE 31F-5-4—PASSING VESSEL



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3105F.3.3 Seiche. *A seiche analysis is required for existing MOTs located within a harbor basin and which have historically experienced seiche. A seiche analysis is required for new MOTs inside a harbor basin prone to penetration of ocean waves.*

The standing wave system or seiche is characterized by a series of "nodes" and "antinodes." Seiche typically has wave periods ranging from 20 seconds up to several hours, with wave heights in the range of 0.1 to 0.4 ft [5.7].

The following procedure may be used, as a minimum, in evaluating the effects of seiche within a harbor basin. In more complex cases where the assumptions below are not applicable, dynamic methods are required.

1. *Calculate the natural period of oscillation of the basin. The basin may be idealized as rectangular, closed or open at the seaward end. Use Chapter 2 of UFC 4-150-06 [5.7] to calculate the wave period and length for different modes. The first three modes shall be considered in the analysis.*
2. *Determine the location of the moored ship with respect to the antinode and node of the first three modes to determine the possibility of resonance.*
3. *Determine the natural period of the vessel and mooring system. The calculation shall be based on the total mass of the system and the stiffness of the mooring lines in surge. The surge motion of the moored vessel is estimated by analyzing the vessel motion as a harmonically forced linear single degree of freedom spring mass system. Methods outlined in a paper by F.A. Kilner [5.8] can be used to calculate the vessel motion.*
4. *Vessels are generally berthed parallel to the channel; therefore, only longitudinal (surge) motions shall be considered, with the associated mooring loads in the spring lines. The loads on the mooring lines (spring lines) are then determined from the computed vessel motion and the stiffness of those mooring lines.*

3105F.3.4 Tsunami. *Run-up and current velocity shall be considered in the tsunami assessment. Section 3103F.5.7 and Table 31F-3-6 provides run-up values for the San Francisco Bay area, Los Angeles/Long Beach Harbors and Port Hueneme.*

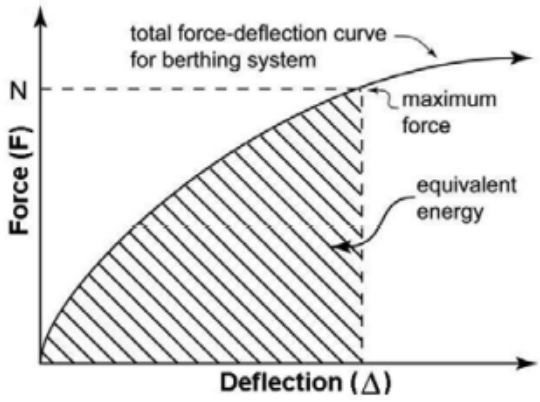
3105F.4 Berthing analysis and design. *The analysis and design of berthing components shall be based on the loading combinations and safety factors defined in Sections 3103F.8 and 3105F.7, and in accordance with ACI 318 [5.1], AISC 325 [5.2] and ANSI/AWC NDS [5.3], as applicable.*

3105F.4.1 Berthing energy demand. *The kinetic berthing energy demand shall be determined in accordance with Section 3103F.6.*

3105F.4.2 Berthing energy capacity. *For existing MOTs, the berthing energy capacity shall be calculated as the area under the force-deflection curve for the combined structure and fender system as indicated in Figure 31F-5-5. Fender piles may be included in the lateral analysis to establish the total force-deflection curve for the berthing system. Load- deflection curves for other fender types shall be obtained from manufacturer's data. The condition of fenders shall be taken into account when performing the analysis.*

When batter piles are present, the fender system typically absorbs most of the berthing energy. This can be established by comparing the force-deflection curves for the fender system and batter piles. In this case only the fender system energy absorption shall be considered.

FIGURE 31F-5-5—BERTHING ENERGY CAPACITY



3105F.4.3 Tanker contact length.

3105F.4.3.1 Continuous fender system. *A continuous fender system consists of fender piles, chocks, wales, and rubber or spring fender units.*

The contact length of a ship during berthing depends on the spacing of the fender piles and fender units, and the connection details of the chocks and wales to the fender piles.

The contact length, L_c, can be calculated using rational analysis considering curvature of the bow and berthing angle.

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In lieu of detailed analysis to determine the contact length, Table 31F-5-1 may be used. The contact length for a vessel within the range listed in the table can be obtained by interpolation.

TABLE 31F-5-1—CONTACT LENGTH	
VESSEL SIZE (DWT)	**CONTACT LENGTH**
330	25 ft
1,000 to 2,500	35 ft
5,000 to 26,000	40 ft
35,000 to 50,000	50 ft
65,000	60 ft
100,000 to 125,000	70 ft

3105F.4.3.2 Discrete fender system. *For discrete fender systems (i.e., not continuous), one fender unit or breasting dolphin shall be able to absorb the entire berthing energy.*

3105F.4.4 Longitudinal and vertical berthing forces. *The longitudinal and vertical components of the horizontal berthing force shall be calculated using appropriate coefficients of friction between the vessel and the fender. In lieu of as-built data, the values in Table 31F-5-2 may be used for typical fender/vessel materials:*

TABLE 31F-5-2—COEFFICIENT OF FRICTION	
CONTACT MATERIALS	**FRICTION COEFFICIENT**
Timber to Steel	0.4 to 0.6
Urethane to Steel	0.4 to 0.6
Steel to Steel	0.25
Rubber to Steel	0.6 to 0.7
UHMW* to Steel	0.1 to 0.2
*Ultra-high molecular weight plastic rubbing strips.	

Longitudinal and vertical forces shall be determined by:

Equation 5-3 $F = \mu N$

where:

F = *longitudinal or vertical component of horizontal berthing force*

μ = *coefficient of friction of contact materials*

N = *maximum horizontal berthing force (normal to fender)*

3105F.4.5 Design and selection of new fender systems. *For guidelines on new fender designs, refer to UFC 4-152-01 [5.9] and PIANC [5.10]. Velocity and temperature factors, contact angle effects and manufacturing tolerances shall be considered (see Appendices A and B of PIANC [5.10]). Also, see Section 3103F.6.*

3105F.5 Layout of new MOTs. *Guidelines for layout of new MOTs are provided in OCIMF MEG3 [5.4]. The final layout of the mooring and breasting dolphins shall be determined based on the results of the mooring analysis that provides optimal mooring line and breasting forces for the range of vessels to be accommodated.*

3105F.6 Offshore moorings. *Offshore MOT moorings shall be designed and analyzed considering the site water depth, metocean environment and class of vessels calling per OCIMF MEG3 [5.4] or UFC 4-159-03 [5.5].*

3105F.6.1 Mooring analyses. *Analysis procedures shall conform to the OCIMF MEG3 [5.4] or UFC 4-159-03 [5.5], and the following:*

1. *A mooring analysis shall be performed for the range of tanker classes and barges calling at each offshore berth.*
2. *Forces acting on moored vessels shall be determined according to Section 3103F.5 and analysis shall consider all possible vessel movements, contribution of buoys, sinkers, catenaries affecting mooring line stiffness and anchorages.*
3. *Correlation of winds, waves and currents shall be considered. The correlation may be estimated by probabilistic analysis of metocean data.*
4. *The actual expected displacement of the vessels shall be used in the analysis.*
5. *Underwater inspections and bathymetry shall be considered.*
6. *Both fully laden and ballast conditions shall be considered.*
7. *Dynamic analysis shall be used to evaluate moorings performance.*

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3105F.6.2 Design of mooring components. *Design of mooring components shall be based on loading combinations and safety factors defined in Sections 3103F.8, 3105F.7 and 3105F.8 and follow the guidelines provided in either the OCIMF MEG3 [5.4] or UFC 4-159-03 [5.5].*

3105F.7 Safety factors for mooring lines. *Safety factors for different material types of mooring lines are given in Table 31F-5-3. The safety factors should be applied to the minimum number of lines specified by the mooring analysis, using the highest loads calculated for the environmental conditions. The minimum breaking load (MBL) of new ropes is obtained from the certificate issued by the manufacturer. If polyamide tails are used in combination with wire mooring lines, the safety factor shall be based on the weaker of the two ropes.*

TABLE 31F-5-3—SAFETY FACTORS FOR ROPES [5.4]	
Steel Wire Rope	1.82
Polyamide	2.22
Other Synthetic	2.00
Polyamide Tail for Wire Mooring Lines	2.50
Other Synthetic Tail for Wire Mooring Lines	2.28
Polyamide Tail for Synthetic Mooring Lines	2.75
Other Synthetic Tail for Synthetic Mooring Lines	2.50
Joining Shackles	2.00

3105F.8 Mooring hardware (N/E). *Mooring hardware shall include, but not be limited to, bollards, quick release hooks, other mooring fittings and base bolts. All mooring hardware shall be clearly marked with their safe working loads (or allowable working loads) [5.4]. The certificate issued by the manufacturer normally defines the safe working loads of this hardware.*

3105F.8.1 Quick release hooks. *For new MOTs or berthing systems, a minimum of three quick release hooks are required for each breasting line location for tankers greater than or equal to 50,000 DWT. At least two hooks at each location shall be provided for breasting lines for tankers less than 50,000 DWT. Remote release may be considered for emergency situations.*

All hooks and supporting structures shall withstand the minimum breaking load (MBL) of the strongest line with a safety factor of 1.2 or greater. Only one mooring line shall be placed on each quick release hook (N/E).

For multiple quick release hooks, the minimum horizontal load for the design of the tie-down shall be:

Equation 5-4 $F_d = 1.2 \times MBL \times [1 + 0.75 (n-1)]$

where:

F_d = *Minimum factored demand for assembly tie-down.*

n = *Number of hooks on the assembly.*

The capacity of the supporting structures must be larger than F_d (See Section 3107F.6).

3105F.8.2 Other fittings. *Other fittings include cleats, bitts and bollards.*

If the allowable working loads for existing fittings are not available, the values listed in Table 31F-5-4 may be used for typical sizes, bolt patterns and layout. The allowable working loads are defined for mooring line angles up to 60 degrees from the horizontal. The combination of vertical and horizontal loads shall be considered.

TABLE 31F-5-4—ALLOWABLE WORKING LOADS			
TYPE OF FITTINGS	**NO. OF BOLTS**	**BOLT SIZE (in)**	**WORKING LOAD (kips)**
30 inch Cleat	4	$1\frac{1}{8}$	20
42 inch Cleat	6	$1\frac{1}{8}$	40
Low Bitt	10	$1\frac{5}{8}$	60 per column
High Bitt	10	$1\frac{3}{4}$	75 per column
$44\frac{1}{2}$ inch Fit. Bollard	4	$1\frac{3}{4}$	70
$44\frac{1}{2}$ inch Fit. Bollard	8	$2\frac{1}{4}$	200
48 inch Fit. Bollard	12	$2\frac{3}{4}$	450
Note: *This table is modified from Table 6-11 of UFC 4-159-03 [5.5]*			

3105F.8.3 Base bolts. *Base bolts are subjected to both shear and uplift. Forces on bolts shall be determined using the following factors:*

1. *Height of load application on bitts or bollards.*

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2. *Actual vertical angles of mooring lines for the highest and lowest tide and vessel draft conditions, for all sizes of vessels at each particular berth.*
3. *Actual horizontal angles from the mooring line configurations, for all vessel sizes and positions at each particular berth.*
4. *Simultaneous loads from more than one vessel.*

For existing MOTs, the deteriorated condition of the base bolts and supporting members shall be considered in determining the capacity of the fitting.

3105F.9 Symbols.

α = *Horizontal mooring line angles*

Δ = *Deflection*

θ = *Vertical mooring line angles*

B = Beam of vessel

DWT = Dead Weight Tonnage

F = Longitudinal or vertical component of horizontal normal berthing force

F_d = *Minimum factored demand for assembly tie-down*

L = Distance between passing and moored vessels

MBL = Minimum breaking load

n = Number of hooks on the assembly

N = Maximum horizontal berthing force

μ = *Coefficient of friction of contact materials*

V = Ground speed (knots)

V_c = *Maximum current (knots).*

V_{crit} = *Ground speed (knots) above which passing loads must be considered*

3105F.10 References.

[5.1] *American Concrete Institute (ACI), 2014, ACI 318-14 (ACI 318), "Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)," Farmington Hills, MI.*

[5.2] *American Institute of Steel Construction, Inc. (AISC), 2017, AISC 325-17 (AISC 325), "Steel Construction Manual," 15th ed., Chicago, IL.*

[5.3] *American Wood Council (AWC), 2017, ANSI/AWC NDS-2018 (ANSI/AWC NDS), "National Design Specification (NDS) for Wood Construction," Washington, D.C.*

[5.4] *Oil Companies International Marine Forum (OCIMF), 2008, "Mooring Equipment Guidelines (MEG3)," 3rd Ed., London, England.*

[5.5] *Department of Defense, 3 October 2005 (Change 2, 23 June 2016), Unified Facilities Criteria (UFC) 4-159-03, "Design: Moorings," Washington D.C.*

[5.6] *American Society of Civil Engineers (ASCE), 2016, ASCE/SEI 7-16 (ASCE/SEI 7), "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," Reston, VA.*

[5.7] *Department of Defense, 12 December 2001 (Change 1, 19 October 2010), Unified Facilities Criteria (UFC) 4-150-06, "Military Harbors and Coastal Facilities," Washington D.C*

[5.8] *Kilner F.A., 1961, "Model Tests on the Motion of Moored Ships Placed on Long Waves." Proceedings of 7th Conference on Coastal Engineering, August 1960, The Hague, Netherlands, published by the Council on Wave Research - The Engineering Foundation.*

[5.9] *Department of Defense, 24 January 2017, Unified Facilities Criteria (UFC) 4-152-01, "Design: Piers and Wharves," Washington D.C.*

[5.10] *Permanent International Association of Navigation Congresses (PIANC), 2002, "Guidelines for the Design of Fender Systems: 2002," Brussels.*

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 6

SECTION 3106F—GEOTECHNICAL HAZARDS AND FOUNDATIONS

3106F.1 General.

3106F.1.1 Purpose. *This section provides minimum standards for analyses and evaluation of geotechnical hazards and foundations under static and seismic conditions.*

3106F.1.2 Applicability. *The requirements provided herein apply to all new and existing MOTs.*

3106F.1.3 Loading. *The loading for geotechnical hazard assessment and foundation analyses under static and seismic conditions is provided in Sections 3103F and 3104F.*

3106F.2 Site characterization. *Site characterization shall be based on site-specific geotechnical information. If existing information is used, the geotechnical engineer of record shall provide adequate justification.*

3106F.2.1 Site classes. *Each MOT shall be assigned at least one site class. Site Classes A, B, C, D and E are defined in Table 31F-6-1, and Site Class F is defined by any of the following:*

1. *Soils vulnerable to significant potential loss of stiffness, strength and/or volume under seismic loading due to liquefiable soils, quick and highly sensitive clays and/or collapsible weakly cemented soils.*
2. *Peats and/or highly organic clays, where the thickness of peat or highly organic clay exceeds 10 feet.*
3. *Very high plasticity clays with a plasticity index (PI) greater than 75, where the thickness of clay exceeds 25 feet.*
4. *Very thick soft/medium stiff clays with undrained shear strength less than 1,000 psf, where the thickness of clay exceeds 120 feet.*

3106F.2.2 Site-specific information.

1. *Site-specific investigations shall include adequate borings and/or cone penetration tests (CPTs) and other appropriate field methods, to enable the determination of geotechnical parameters.*
2. *Adequate coverage of subsurface data, both horizontally and vertically, shall be obtained to develop geotechnical parameters.*
3. *Exploration shall be deep enough to characterize subsurface materials that are affected by embankment behavior and shall extend to depth of at least 20 feet below the deepest foundation depth.*
4. *During field exploration, particular attention shall be given to the presence of continuous low-strength layers or thin soil layers that could liquefy or weaken during the design earthquake shaking.*
5. *CPTs provide continuous subsurface profile and shall be used to complement exploratory borings. When CPTs are performed, at least one boring shall be performed next to one of the CPT soundings to check that the CPT-soil behavior type interpretations are reasonable for the site. Any difference between CPT interpretation and subsurface condition obtained from borings shall be reconciled.*
6. *Quantitative site soil stratigraphy is required to a depth of 100 feet for assigning a site class (see Table 31F-6-1).*
7. *Laboratory tests may be necessary to supplement the borings and insitu field tests.*

TABLE 31F-6-1—SITE CLASSES

SITE CLASS	SOIL PROFILE	AVERAGE VALUES FOR TOP 100 FEET OF SOIL PROFILE[3]		
		Shear Wave Velocity, V_s [ft/sec]	Standard Penetration Test, SPT [blows/ft]	Undrained Shear Strength, S_u [psf]
A	Hard Rock	> 5,000		
B	Rock	2,500 to 5,000		
C	Very Stiff/Very Dense Soil and Soft Rock	1,200 to 2,500	> 50	> 2,000
D	Soft/Dense Soil Profile	600 to 1,200	15 to 50	1,000 to 2,000
E[1, 2]	Soft/Loose Soil Profile	< 600	< 15	< 1,000
F	Defined in Section 3106F.2.1			

1. Site Class E also includes any soil profile with more than 10 feet of soft clay (defined as a soil with a plasticity index, PI > 20, water content > 40 percent and S_u < 500 psf).
2. The plasticity index, P1, and the moisture content shall be determined in accordance with ASTM D4318 [6.1] and ASTM D2216 [6.2], respectively.
3. Conversion of CPT data to estimate equivalent V_s, SPT blow count, or S_u is allowed.

3106F.3 Seismic loads for geotechnical evaluations. *Section 3103F.4 defines the earthquake loads to be used for structural and geotechnical evaluations in terms of design Peak Ground Accelerations (PGA), spectral accelerations and design earthquake magnitude. Values used for analyses are based on Probabilistic Seismic Hazard Analyses (PSHA) using two levels of seismic performance criteria (Section 3104F.2.1 and Table 31F-4-1).*

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3106F.4 Liquefaction potential. *The liquefaction potential of the soils in the immediate vicinity of or beneath each MOT, and associated slopes, embankments or rock dikes shall be evaluated for the PGAs associated with seismic performance Levels 1 and 2. Liquefaction potential evaluation should follow the procedures outlined in NCEER report [6.3], SCEC [6.4] and CGS Special Publication 117A [6.5].*

If liquefaction is shown to be initiated in the above evaluations, the particular liquefiable strata and their thicknesses shall be clearly shown on site profiles. Resulting hazards associated with liquefaction shall be addressed including translational or rotational deformations of slopes or embankment systems and post liquefaction settlement of slopes or embankment systems and underlying foundation soils, as noted below. If such analyses indicate the potential for partial or gross (flow) failure of a slope or embankment, adequate evaluations shall be performed to confirm such a condition exists, together with analyses to evaluate potential slope displacements (lateral spreads). In these situations and for projects where more detailed numerical analyses are performed, a peer review (see Section 3101F.8.2) may be required.

3106F.5 Slope or embankment stability and seismically induced lateral spreading. *Slope or embankment stability related to the MOT facility, shall be evaluated for static and seismic loading conditions.*

3106F.5.1 Static slope stability. *Static stability analysis using conventional limit equilibrium methods shall be performed for site related slope or embankment systems. Live load surcharge shall be considered in analyses based on project-specific information. The long-term static factor of safety of the slope or embankment shall not be less than 1.5.*

3106F.5.2 Pseudo-static seismic slope stability. *Pseudo-static seismic slope or embankment stability analyses shall be performed to estimate the horizontal yield acceleration for the slope for the Level 1 and Level 2 earthquakes. During the seismic event, appropriate live load surcharge shall be considered.*

If liquefaction and/or strength loss of the site soils is likely, the following shall be used in the analyses, as appropriate:

1. *Residual strength of liquefied soils*
2. *Strengths compatible with the pore-pressure generation of potentially liquefiable soils*
3. *Potential strength reduction of clays*

The residual strength of liquefied soils shall be estimated using guidelines outlined in SCEC [6.4] or other appropriate documents as noted in CGS Special Publication 117A [6.5].

Pseudo-static analysis shall be performed without considering the presence of the foundation system. Using a horizontal seismic coefficient of one-half of the PGA, if the estimated factor of safety is greater than or equal to 1.1, then no further evaluation of lateral spreading or kinematic loading from lateral spreading is required.

3106F.5.3 Post-earthquake static slope stability. *The static factor of safety immediately following a design earthquake event shall not be less than 1.1 when any of the following are used in static stability analysis:*

1. *Post-earthquake residual strength of liquefied soils*
2. *Strengths compatible with the pore-pressure generation of potentially liquefiable soils*
3. *Potential strength reduction of clays*

3106F.5.4 Lateral spreading – Free field. *The earthquake–induced lateral deformations of the slope or embankment and associated foundations soils shall be determined for the Level 1 and Level 2 earthquakes using the associated PGA at the ground surface (not modified for liquefaction). If liquefaction and/or strength loss of the site soils is likely, the following shall be used in the analyses, as appropriate:*

1. *Residual strength of liquefied soils*
2. *Strengths compatible with the pore-pressure generation of potentially liquefiable soils*
3. *Potential strength reduction of clays*

The presence of the foundation system shall not be included in the "free field" evaluations.

Initial lateral spread estimates shall be made using the Newmark displacement approach documented in NCHRP Report 611 [6.6] or other appropriate but similar procedures.

3106F.6 Seismically induced settlement. *Seismically induced settlement shall be evaluated. Based on guidelines outlined in SCEC [6.4] or other appropriate documents such as CGS Special Publication 117A [6.5]. If seismically induced settlement is anticipated, the resulting design impacts shall be considered, including the potential development of downdrag loads on piles.*

3106F.7 Earth pressures. *Both static and seismic earth pressures acting on MOT structures shall be evaluated.*

3106F.7.1 Earth pressures under static loading. *The effect of static active earth pressures on structures resulting from static loading of backfill soils shall be considered where appropriate. Backfill sloping configuration, if applicable, and backland loading conditions shall be considered in the evaluations. The loading considerations shall be based on project-specific information. The earth pressures under static loading should be based on guidelines outlined in NAVFAC DM7-02 [6.7] or other appropriate documents.*

3106F.7.2 Earth pressures under seismic loading. *The effect of earth pressures on structures resulting from seismic loading of backfill soils, including the effect of pore-water pressure build-up in the backfill, shall be considered. The seismic coefficients used for this analysis shall be based on the Level 1 and Level 2 earthquake PGA values.*

Evaluation of earth pressures under seismic loading, should be based on NCHRP Report 611 [6.6] or other appropriate methods.

3106F.8 Pile axial behavior.

3106F.8.1 Axial pile capacity. *Axial geotechnical capacity of piles under static loading shall be evaluated using guidelines for estimating axial pile capacities provided in POLB WDC [6.8] or other appropriate documents. A minimum factor of safety of 2.0 shall be achieved on the ultimate capacity of the pile using appropriate MOT loading.*

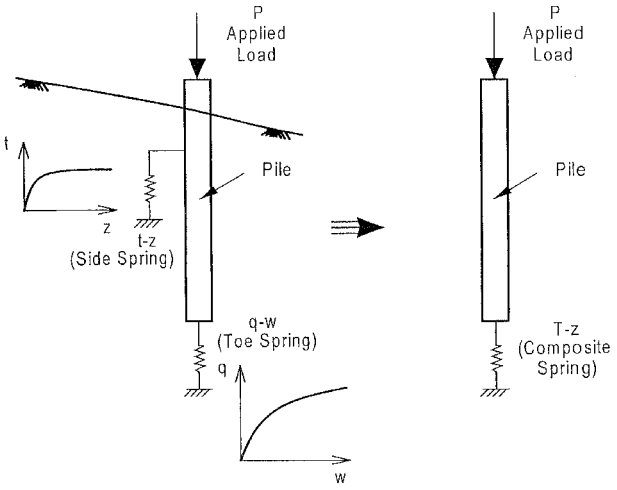
If liquefaction or seismically-induced settlement is anticipated, the ultimate axial geotechnical capacity of piles under seismic conditions shall be evaluated for the effects of liquefaction and/or downdrag forces on the pile. The ultimate geotechnical capacity of the pile during liquefaction shall be determined on the basis of the residual strength of the soil for those layers where the factor of safety for liquefaction is determined to be less than 1.0.

When seismically-induced settlements are predicted to occur during design earthquakes, the downdrag loads shall be computed, and the combination of downdrag load and static load determined. Only the tip resistance of the pile and the side friction resistance below the lowest layer contributing to the downdrag shall be used in the capacity evaluation. The ultimate axial geotechnical capacity of the pile shall not be less than the combination of the seismically induced downdrag force and the maximum static load.

3106F.8.2 Axial springs for piles. *The geotechnical analyst (see Section 3102F.3.4.8) shall coordinate with the structural analyst (see Section 3102F.3.4.4) and develop axial springs (T-z) for piles. The T-z springs may be developed either at the top or at the tip of the pile (see Figure 31F-6-1). If the springs are developed at the pile tip, the tip shall include both the friction resistance along the pile (i.e., side springs [t-z]) and tip resistance at the pile tip (i.e. tip springs [q-w]), as illustrated in Figure 31F-6-1. If T-z springs are developed at the pile top, the appropriate elastic shortening of the pile shall be included in the springs. Linear or nonlinear springs may be developed if requested by the structural analyst.*

Due to the uncertainties associated with the development of axial springs, such as the axial soil capacities, load distributions along the piles and simplified spring stiffnesses, both upper-bound and lower-bound limits shall be estimated and utilized in the analyses.

FIGURE 31F-6-1—AXIAL SOIL SPRINGS [6.8]



3106F.9 Soil springs for lateral pile loading. *For design of piles under loading associated with the inertial response of the superstructure, level-ground inelastic lateral springs (p-y) shall be developed. The lateral springs within the shallow portion of the piles (generally within 10 pile diameters below the ground surface) tend to dominate the inertial behavior. Geotechnical parameters for developing lateral soil springs shall follow guidelines provided in API RP 2A-WSD [6.9] or other appropriate documents.*

Due to uncertainties associated with the development of p-y curves for dike structures, upper-bound and lower-bound p-y springs shall be developed for use in superstructure inertial response analyses.

3106F.10 Soil-pile interaction. *Two separate loading conditions for the piles shall be considered:*

1. *Inertial loading under seismic conditions*
2. *Kinematic loading from lateral ground spreading*

Inertial loading is associated with earthquake-induced lateral loading on a structure, while kinematic loading refers to loading on foundation piles from earthquake induced lateral deformations of the slope/ embankment/dike system. Simultaneous application of these loading conditions shall be evaluated with due consideration of the phasing and locations of these loads on foundation elements. The foundation shall be designed such that the structural performance is acceptable when subjected to both inertial and kinematic loadings.

3106F.10.1 Inertial loading under seismic conditions. *The lateral soil springs shall be used in inertial loading response analyses. The evaluation of inertial loading can be performed by ignoring potential slope/embankment/dike system deformations (i.e., one end of the lateral soil spring at a given depth is attached to the corresponding pile node and the other end is assumed fixed).*

3106F.10.2 Kinematic loading from lateral spreading. *Kinematic pile loading from permanent lateral spread ground deformation in deep seated levels of slope/embankment/dike foundation soils shall be evaluated. The lateral deformations shall be restricted such that the structural performance of foundation piles is not compromised.*

The lateral deformation of the embankment or dike and associated piles and foundation soils shall be determined using analytical methods as follows:

1. *Initial estimates of free field lateral spread deformations (in the absence of piles) may be determined using the simplified Newmark sliding block method as described in Section 3106F.5.4. The geotechnical analyst shall provide the structural*

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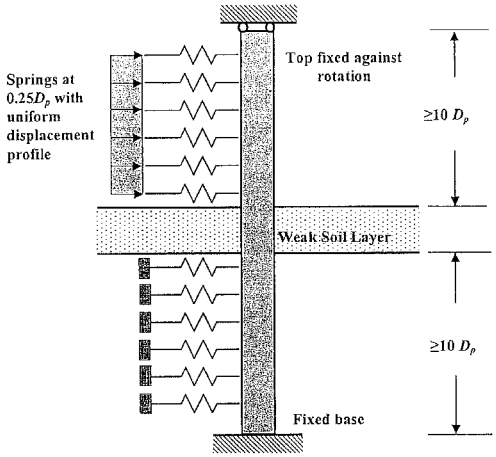
analyst with level-ground p-y curves for the weak soil layer controlling the lateral spread and soil layers above and below the weak layer. Appropriate overburden pressures shall be used in simplified pushover analyses, to estimate the pile displacement capacities and corresponding pile shear within the weak soil zone.

2. *For the pushover analysis, the estimated displacements may be uniformly distributed within the thickness of the weak soil layer (i.e., zero at and below the bottom of the layer to the maximum value at and above the top of the weak layer). The thickness of the weak soil layer used in the analysis (failure zone) shall not be more than five times the pile diameter or 10 feet, whichever is smaller.*
3. *For a simplified analysis (see Figure 31F-6-2), the pile shall be fixed against rotation and translation relative to the soil displacement at some distance above and below the weak soil layer. Between these two points, lateral soil springs are provided, which allow deformation of the pile relative to the deformed soil profile.*

FIGURE 31F-6-2—SLIDING LAYER MODEL [6.8]



3106F.11 Soil-structure interaction – Shallow foundations and underground structures.

3106F.11.1 Shallow foundations. *Shallow foundations shall be assumed to move with the ground. Springs and dashpots may be evaluated as per Gazetas [6.10].*

3106F.11.2 Underground structures. *Buried flexible structures or buried portions of flexible structures including piles and pipelines shall be assumed to deform with estimated ground movement at depth.*

As the soil settles, it shall be assumed to apply shear forces to buried structures or buried portions of structures including deep foundations.

3106F.12 Underwater seafloor pipelines. *Geotechnical evaluations of underwater pipelines shall include static stability of the seafloor ground supporting the pipeline and settlement and lateral deformation of the ground under earthquakes. If the pipeline is buried, the potential for uplift of the pipeline under earthquakes shall also be evaluated.*

3106F.13 Symbols.

A = Site Class A as defined in Table 31F-6-1

B = Site Class B as defined in Table 31F-6-1

C = Site Class C as defined in Table 31F-6-1

CPT =Cone Penetration Test

D = Site Class D as defined in Table 31F-6-1

D_p = Pile diameter

E = Site Class E as defined in Table 31F-6-1

F = Site Class F as defined in Table 31F-6-1

P = Applied load

PI = Plasticity index

p-y = Lateral soil spring

S_U = Undrained shear strength

SPT = Standard Penetration Test

t-z = Axial soil spring along the side of pile

T-z = Composite axial soil spring at pile tip

q-w = Axial soil spring at pile tip

V_S = Shear wave velocity

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3106F.14 References.

[6.1] American Society for Testing and Materials (ASTM), 2014, ASTM D4318-10 (ASTM D4318), "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils," West Conshohocken, PA.

[6.2] American Society for Testing and Materials (ASTM), 2014, ASTM D2216-10 (ASTM D2216), "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass," West Conshohocken, PA.

[6.3] Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G. Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F. Jr., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.S.C., Marcuson, W.F., III, Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R.B., and Stokoe, K.H., II, 2001, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Volume 127, No. 10, p. 817-833.

[6.4] Southern California Earthquake Center (SCEC), March 1999, "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction in California," University of Southern California, Los Angeles.

[6.5] California Department of Conservation, California Geological Survey (CGS), 11 September 2008, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," Special Publication 117A, Revised Release.

[6.6] National Cooperative Highway Research Program (NCHRP), 2008, "NCHRP Report 611: Seismic Analysis and Design of Retaining Walls, Buried Structures, Slopes, and Embankments," Washington, D.C.

[6.7] Naval Facilities Engineering Command (NAVFAC), 1986, NAVFAC DM7-02, "Foundation and Earth Structures," Alexandria, VA.

[6.8] Port of Long Beach (POLB), 2012 February 29, "Wharf Design Criteria (WDC)," Version 3.0, Long Beach, CA.

[6.9] American Petroleum Institute (API), November 2014, API Recommended Practice 2A-WSD (API RP 2A-WSD), "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design," 22nd ed., Washington, D.C.

[6.10] Gazetas, G., September 1991, "Formulas and Charts for Impedances of Surface and Embedded Foundations," Journal of Geotechnical Engineering, ASCE, Vol. 117, No. 9.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

SECTION 3107F—STRUCTURAL ANALYSIS AND DESIGN OF COMPONENTS

3107F.1 General.

3107F.1.1 Purpose. *This section establishes the minimum performance standards for structural and nonstructural components. Evaluation procedures for seismic performance, strength and deformation characteristics of concrete, steel and timber components are prescribed herein. Analytical procedures for seismic assessment are presented in Section 3104F.*

3107F.1.2 Applicability. *This section addresses MOT structures constructed using the following structural components:*

1. *Reinforced concrete decks supported by batter and/or vertical concrete piles*
2. *Reinforced concrete decks supported by batter and/or vertical steel piles, including pipe piles filled with concrete*
3. *Reinforced concrete decks supported by batter and/or vertical timber piles*
4. *Timber decks supported by batter or vertical timber, concrete or steel pipe piles*
5. *Retaining structures constructed of steel, concrete sheet piles or reinforced concrete*

Additionally, this section addresses structural and nonstructural components, nonbuilding structures and building structures comprised of steel, concrete or timber.

3107F.2 Concrete deck with concrete or steel piles.

3107F.2.1 Component strength. *The following parameters shall be established in order to compute the component strength:*

1. *Specified concrete compressive strengths*
2. *Concrete and steel modulus of elasticity*
3. *Yield and tensile strength of mild reinforcing and prestressed steel and corresponding strains*
4. *Confinement steel strength and corresponding strains*
5. *Embedment length*
6. *Concrete cover*
7. *Yield and tensile strength of structural steel*
8. *Ductility*

In addition, for “existing” components, the following conditions shall be considered:

9. *Environmental effects, such as reinforcing steel corrosion, concrete spalling, cracking and chemical attack*
10. *Fire damage*
11. *Past and current loading effects, including overload, fatigue or fracture*
12. *Earthquake damage*
13. *Discontinuous components*
14. *Construction deficiencies*

3107F.2.1.1 Material properties. *Material properties of existing components, not determined from testing procedures, and of new components, shall be established using the following methodology.*

The strength of structural components shall be evaluated based on the following values (Section 5.3 of [7.1] and pp. 3-73 and 3-74 of [7.2]):

Specified material strength shall be used for nonductile components (shear controlled), all mechanical, electrical and mooring equipment (attachments to the deck) and for all non seismic load combinations:

Equation 7-1a $f'_c = 1.0 f'_c$

Equation 7-1b $f_y = 1.0 f_y$

Equation 7-1c $f_p = 1.0 f_p$

In addition, these values (7-1a, 7-1b and 7-1c) may be used conservatively as alternatives to determine the nominal strength of ductile components (N).

Expected lower bound estimates of material strength shall be used for determination of moment-curvature relations and nominal strength of all ductile components:

Equation 7-2a $f'_c = 1.3 f'_c$

Equation 7-2b $f_y = 1.1 f_y$

Equation 7-2c $f_p = 1.0 f_p$

Upper bound estimates of material strength shall be used for the determination of moment-curvature relations, to obtain the feasible maximum demand on capacity protected members:

Equation 7-3a $f'_c = 1.7 f'_c$

Equation 7-3b $f_y = 1.3 f_y$

Equation 7-3c $f_p = 1.1 f_p$

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where:

f'_c = *Specified compressive strength of concrete*

f_y = *Specified yield strength of reinforcement or specified minimum yield stress steel*

f_p = *Specified yield strength of prestress strands*

"Capacity Design" (Section 5.3 of [7.1]) ensures that the strength at protected components (such as pile caps and decks), joints and actions (such as shear), is greater than the maximum feasible demand (over strength), based on realistic upper bound estimates of plastic hinge flexural strength. An additional series of nonlinear analyses using moment curvature characteristics of pile hinges may be required.

Alternatively, if a moment-curvature analysis is performed that takes into account the strain hardening of the steel, the demands used to evaluate the capacity protected components may be estimated by multiplying the moment-curvature values by 1.25.

Based on a historical review of the building materials used in the twentieth century, guidelines for tensile and yield properties of concrete reinforcing bars and the compressive strength of structural concrete have been established (see Tables 10-2 to 10-4 of ASCE/SEI 41 [7.3]). The values shown in these tables can be used as default properties, only if as-built information is not available and testing is not performed. The values in Tables 31F-7-1 and 31F-7-2, are adjusted according to Equations (7-1) through (7-3).

3107F.2.1.2 Knowledge factor (k). *Knowledge factor, k, shall be applied on a component basis.*

The following information is required, at a minimum, for a component strength assessment:

1. *Original construction records, including drawings and specifications.*
2. *A set of "as-built" drawings and/or sketches, documenting both gravity and lateral systems (Section 3102F.1.5) and any postconstruction modification data.*
3. *A visual condition survey, for structural components including identification of the size, location and connections of these components.*
4. *In the absence of material properties, values from limited in-situ testing or conservative estimates of material properties (Tables 31F-7-1 and 31F-7-2).*
5. *Assessment of component conditions, from an in- situ evaluation, including any observable deterioration.*
6. *Detailed geotechnical information, based on recent test data, including risk of liquefaction, lateral spreading and slope stability.*

The knowledge factor, k, is 1.0 when comprehensive knowledge as specified above is utilized. Otherwise, the knowledge factor shall be 0.75 (see Section 5.2.6 of ASCE/SEI 41 [7.3]).

TABLE 31F-7-1—COMPRESSIVE STRENGTH OF STRUCTURAL CONCRETE (psi)[1]

TIME FRAME	PILING	BEAMS	SLABS
1900-1919	2,500-3,000	2,000-3,000	1,500-3,000
1920-1949	3,000-4,000	2,000-3,000	2,000-3,000
1950-1965	4,000-5,000	3,000-4,000	3,000-4,000
1966-present	5,000-6,000	3,000-5,000	3,000-5,000

1. Concrete strengths are likely to be highly variable for an older structure.

TABLE 31F-7-2—TENSILE AND YIELD PROPERTIES OF REINFORCING BARS FOR VARIOUS ASTM SPECIFICATIONS AND PERIODS (after Table 6-2 of [7.3])

ASTM	STEEL TYPE	YEAR RANGE[3]	GRADE	STRUCTURAL[1] 33	INTERMEDIATE[1] 40	HARD[1] 50	60	70	75
			Minimum Yield[2] (psi)	33,000	40,000	50,000	60,000	70,000	75,000
			Minimum Tensile[2] (psi)	55,000	70,000	80,000	90,000	95,000	100,000
A15	Billet	1911-1966		X	X	X			
A16	Rail[4]	1913-1966				X			
A61	Rail[4]	1963-1966					X		
A160	Axle	1936-1964		X	X	X			
A160	Axle	1965-1966		X	X	X	X		
A408	Billet	1957-1966		X	X	X			
A431	Billet	1959-1966							X
A432	Billet	1959-1966					X		

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TABLE 31F-7-2—TENSILE AND YIELD PROPERTIES OF REINFORCING BARS FOR VARIOUS ASTM SPECIFICATIONS AND PERIODS (after Table 6-2 of [7.3])—continued

ASTM	STEEL TYPE	YEAR RANGE[3]	GRADE	STRUCTURAL[1] 33	INTERMEDIATE[1] 40	HARD[1] 50	60	70	75
			Minimum Yield[2] (psi)	33,000	40,000	50,000	60,000	70,000	75,000
			Minimum Tensile[2] (psi)	55,000	70,000	80,000	90,000	95,000	100,000
A615	Billet	1968-1972			X		X		X
A615	Billet	1974-1986			X		X		
A615	Billet	1987-1997			X		X		X
A616	Rail[4]	1968-1997					X		
A617	Axle	1968-1997			X		X		
A706	Low-Alloy[5]	1974-1997						X	
A955	Stainless	1996-1997			X		X		X

General Note: An entry "X" indicates that grade was available in those years.

1. The terms structural, intermediate and hard became obsolete in 1968.
2. Actual yield and tensile strengths may exceed minimum values.
3. Until about 1920, a variety of proprietary reinforcing steels were used. Yield strengths are likely to be in the range from 33,000 psi to 55,000 psi, but higher values are possible. Plain and twisted square bars were sometimes used between 1900 and 1949.
4. Rail bars should be marked with the letter "R."
5. ASTM steel is marked with the letter "W."

3107F.2.2 Component stiffness. *Stiffness that takes into account the stress and deformation levels experienced by the component shall be used. Nonlinear load-deformation relations shall be used to represent the component load-deformation response. However, in lieu of using nonlinear methods to establish the stiffness and moment curvature relation of structural components, the equations of Table 31F-7-3 may be used to approximate the effective elastic stiffness, EI_e, for lateral analyses (see Section 3107F.8 for definition of symbols).*

TABLE 31F-7-3—EFFECTIVE ELASTIC STIFFNESS

CONCRETE COMPONENT	EI_e/EI_g
Reinforced Pile	$0.3 + N/(f'_c A_g)$
Pile/Deck Dowel Connection[1]	$0.3 + N/(f'_c A_g)$
Prestressed Pile[1]	$0.6 < EI_e/EI_g < 0.75$
Steel Pile	1.0
Concrete w/ Steel Casing	$\frac{E_s I_s + 0.25 E_c I_c}{(E_s I_s + E_c I_c)}$
Deck	0.5

1. The pile/deck connection and prestressed pile may also be approximated as one member with an average stiffness of $0.42 EI_e/EI_g$ (Ferritto et al, 1999 [7.2])

N = is the axial load level.
E_s = Young's modulus for steel
I_s = Moment of inertia for steel section
E_c = Young's modulus for concrete
I_c = Moment of inertia for uncracked concrete section

3107F.2.3 Deformation capacity of flexural members. *Stress-strain models for confined and unconfined concrete, mild and prestressed steel presented in Section 3107F.2.4 shall be used to perform the moment-curvature analysis.*

The stress-strain characteristics of steel piles shall be based on the actual steel properties. If as-built information is not available, the stress-strain relationship may be obtained per Section 3107F.2.4.2.

For concrete in-filled steel piles, the stress-strain model for confined concrete shall be in accordance with Section 3107F.2.4.1.

Each structural component expected to undergo inelastic deformation shall be defined by its moment-curvature relation. The displacement demand and capacity shall be calculated per Sections 3104F.2 and 3104F.3, as appropriate.

The moment-rotation relationship for concrete components shall be derived from the moment-curvature analysis per Section 3107F.2.5.4 and shall be used to determine lateral displacement limitations of the design. Connection details shall be examined per Section 3107F.2.7.

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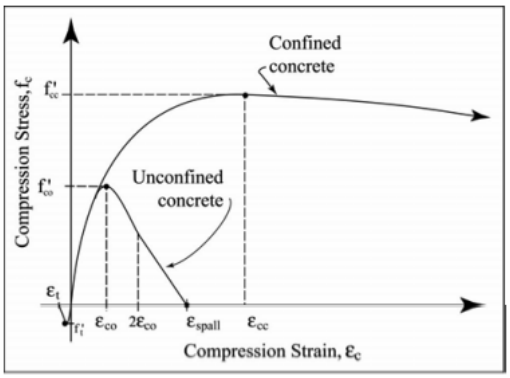
3107F.2.4 Stress-Strain models.

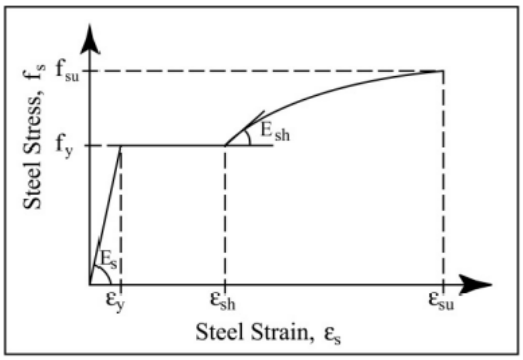
3107F.2.4.1 Concrete. *The stress-strain model and terms for confined and unconfined concrete are shown in Figure 31F-7-1.*

FIGURE 31F-7-1—STRESS-STRAIN CURVES FOR CONFINED AND UNCONFINED CONCRETE [7.1]



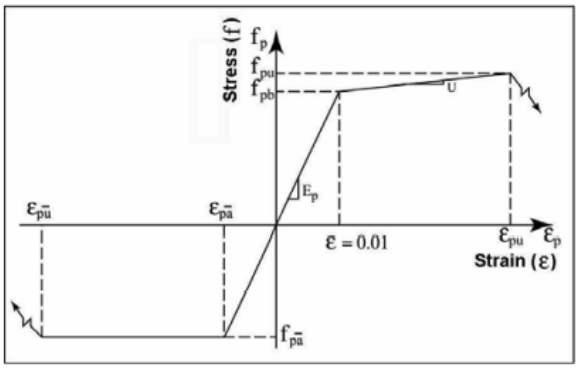
3107F.2.4.2 Reinforcement steel and structural steel. *The stress-strain model and terms for reinforcing and structural steel are shown in Figure 31F-7-2.*

FIGURE 31F-7-2—STRESS-STRAIN CURVE FOR MILD REINFORCING STEEL OR STRUCTURAL STEEL [7.1]



3107F.2.4.3 Prestressed steel. *The stress-strain model of Blakeley and Park [7.4] may be used for prestressed steel. The model and terms are illustrated in Figure 31F-7-3.*

FIGURE 31F-7-3—STRESS-STRAIN CURVE FOR PRESTRESSED STEEL [7.4]



3107F.2.4.4 Alternative stress-strain models. *Alternative stress-strain models are acceptable if adequately documented and supported by test results, subject to Division approval.*

3107F.2.5 Concrete piles.

3107F.2.5.1 General. *The capacity of concrete piles is based on permissible concrete and steel strains corresponding to the desired performance criteria.*

Different values may apply for plastic hinges forming at in-ground and pile-top locations. These procedures are applicable to circular, octagonal, rectangular and square pile cross sections.

3107F.2.5.2 Stability. *Stability considerations are important to pier-type structures. The moment-axial load interaction shall consider effects of high slenderness ratios (kl/r). An additional bending moment due to axial load eccentricity shall be incorporated unless:*

Equation 7-4 $e/h \le 0.10$

where:

e = eccentricity of axial load

h = width of pile in considered direction

3107F.2.5.3 Plastic hinge length. *The plastic hinge length is required to convert the moment-curvature relationship into a moment-plastic rotation relationship for the nonlinear pushover analysis.*

The pile's plastic hinge length, L_p (above ground) for reinforced concrete piles, when the plastic hinge forms against a supporting member is:

Equation 7-5 $L_p = 0.08L + 0.15 f_{ye} d_b \ge 0.3 f_{ye} d_b$

where:

L = distance from the critical section of the plastic hinge to the point of contraflexure

d_b = diameter of the longitudinal reinforcement or dowel, whichever is used to develop the connection

f_{ye} = design yield strength of longitudinal reinforcement or dowel, whichever is used to develop the connection (ksi)

If a large reduction in moment capacity occurs due to spalling, then the plastic hinge length shall be:

Equation 7-6 $L_p = 0.3 f_{ye} d_b$

The plastic hinge length, L_p (above ground), for prestressed concrete piles may also be computed from Table 31F-7-4 for permitted pile-to-deck connections as described in ASCE/COPRI 61 [7.5].

When the plastic hinge forms in-ground, the plastic hinge length may be determined using Equation (7-7) [7.5]:

Equation 7-7 $L_p = 2D$

where:

D = pile diameter or least cross-sectional dimension

TABLE 31F-7-4—PLASTIC HINGE LENGTH FOR PRESTRESSED CONCRETE PILES [7.5]

CONNECTION TYPE	***L_p AT DECK (in.)***
Pile Buildup	$0.15 f_{ye} d_b \le L_p \le 0.30 f_{ye} d_b$
Extended Strand	$0.20 f_{pye} d_{st}$
Embedded Pile	$0.5D$
Dowelled	$0.25 f_{ye} d_b$
Hollow Dowelled	$0.20 f_{ye} d_b$
External Confinement	$0.30 f_{ye} d_b$
Isolated Interface	$0.25 f_{ye} d_b$

d_b = diameter of the prestressing strand or dowel, whichever is used to develop the connection (in.)
f_{ye} = design yield strength of prestressing strand or dowel, as appropriate (ksi)
D = pile diameter or least cross-sectional dimension
d_{st} = diameter of the prestressing strand (in.)
f_{pye} = design yield strength of prestressing strand (ksi)

3107F.2.5.4 Plastic rotation. *The plastic rotation is:*

Equation 7-8 $\theta_p = L_p \phi_p = L_p (\phi_m - \phi_y)$

where:

L_p = plastic hinge length

ϕ_p = plastic curvature

ϕ_m = maximum curvature

ϕ_y = yield curvature

The maximum curvature, ϕ_m shall be determined by the concrete or steel strain limit state at the prescribed performance level, whichever comes first.

Alternatively, the maximum curvature, ϕ_m may be calculated as:

Equation 7-9 $\phi_m = \dfrac{\varepsilon_{cm}}{c_u}$

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where:

ε_{cm} = *maximum limiting compression strain for the prescribed performance level (Table 31F-7-5)*

c_u = *neutral-axis depth, at ultimate strength of section*

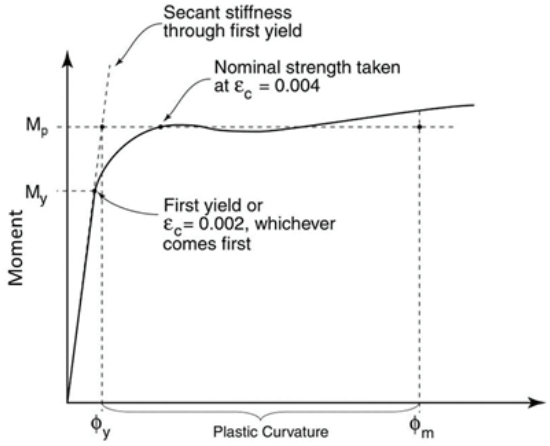
Either Method A or B may be used for idealization of the moment-curvature curve.

TABLE 31F-7-5—LIMITS OF STRAIN		
COMPONENT STRAIN	***LEVEL 1***	***LEVEL 2***
MCCS Pile/deck hinge	$\varepsilon_c \le 0.004$	$\varepsilon_c \le 0.025$
MCCS In-ground hinge	$\varepsilon_c \le 0.004$	$\varepsilon_c \le 0.008$
MRSTS Pile/deck hinge	$\varepsilon_s \le 0.01$	$\varepsilon_s \le 0.05$
MRSTS In-ground hinge	$\varepsilon_s \le 0.01$	$\varepsilon_s \le 0.025$
MPSTS In-ground hinge	$\varepsilon_p \le 0.005$ *(incremental)*	$\varepsilon_p \le 0.025$ *(total strain)*
MCCS = Maximum Concrete Compression Strain, ε_c *MRSTS = Maximum Reinforcing Steel Tension Strain,* ε_s *MPSTS = Maximum Prestressing Steel Tension Strain,* ε_p		

3107F.2.5.4.1 Method A. *For Method A, the yield curvature, ϕ_y is the curvature at the intersection of the secant stiffness, EI_e, through first yield and the nominal strength, ($\varepsilon_c = 0.004$).*

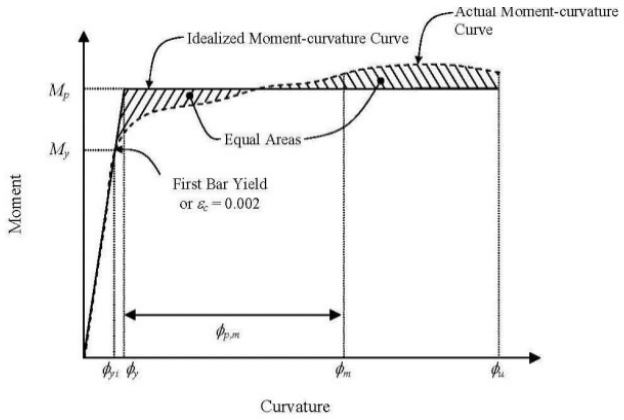
Equation 7-10 $$\phi_y = \frac{M_y}{EI_c}$$

FIGURE 31F-7-4—METHOD A - MOMENT CURVATURE ANALYSIS



3107F.2.5.4.2 Method B. *For Method B, the elastic portion of the idealized moment-curvature curve is the same as in Method A (see Section 3107F.2.5.4.1). However, the idealized plastic moment capacity, M_p, and the yield curvature, ϕ_y, is obtained by balancing the areas between the actual and the idealized moment-curvature curves beyond the first yield point (see Figure 31F-7-5). Method B applies to moment-curvature curves that do not experience reduction in section moment capacity.*

FIGURE 31F-7-5—METHOD B – MOMENT CURVATURE ANALYSIS [7.6]



3107F.2.5.5 Ultimate concrete and steel flexural strains. *Strain values computed in the nonlinear pushover analysis shall be compared to the following limits.*

3107F.2.5.5.1 Unconfined concrete piles: *An unconfined concrete pile is defined as a pile having no confinement steel or one in which the spacing of the confinement steel exceeds 12 inches.*

Ultimate concrete compressive strain:

Equation 7-11 $\varepsilon_{cu} = 0.005$

3107F.2.5.5.2 Confined concrete piles: *Ultimate concrete compressive strain [7.1]:*

Equation 7-12 $\varepsilon_{cu} = 0.004 + (1.4\rho_s f_{yh}\varepsilon_{sm})/f'_{cc} \geq 0.005$

$\varepsilon_{cu} \leq 0.025$

where:

ρ_s = *effective volume ratio of confining steel*

f_{yh} = *yield stress of confining steel*

ε_{sm} = *strain at peak stress of confining reinforcement, 0.15 for grade 40, 0.10 for grade 60*

f'_{cc} = *confined strength of concrete approximated by 1.5* f'_{cc}

3107F.2.5.6 Component acceptance/damage criteria. *The maximum allowable concrete strains may not exceed the ultimate values defined in Section 3107F.2.5.5. The limiting values (Table 31F-7-5) apply for each performance level for both existing and new structures. The "Level 1 or 2" refer to the seismic performance criteria (see Section 3104F.2.1).*

For all non-seismic loading combinations, concrete components shall be designed in accordance with the ACI 318 [7.7] requirements.

Note that for existing facilities, the pile/deck hinge may be controlled by the capacity of the dowel reinforcement in accordance with Section 3107F.2.7.

3107F.2.5.7 Shear design. *If expected lower bound of material strength Section 3107F.2.1.1 Equations (7-2a, 7-2b, 7-2c) are used in obtaining the nominal shear strength, a new nonlinear analysis utilizing the upper bound estimate of material strength Section 3107F.2.1.1 Equations (7-3a, 7-3b, 7-3c) shall be used to obtain the plastic hinge shear demand. An alternative conservative approach is to multiply the maximum shear demand,* V_{max} *from the original analysis by 1.4 (Section 8.16.4.4.2 of ATC-32 [7.8]):*

Equation 7-13 $V_{design} = 1.4V_{max}$

If moment curvature analysis that takes into account strain-hardening, an uncertainty factor of 1.25 may be used:

Equation 7-14 $V_{design} = 1.25V_{max}$

Shear capacity shall be based on nominal material strengths, and reduction factors according to ACI 318 [7.7].

As an alternative, the method of Kowalski and Priestley [7.9] may be used. Their method is based on a three-parameter model with separate contributions to shear strength from concrete (V_c*), transverse reinforcement (*V_s*), and axial load (*V_p*) to obtain nominal shear strength (*V_n*):*

Equation 7-15 $V_n = V_c + V_s + V_p$

A shear strength reduction factor of 0.85 shall be applied to the nominal strength, V_n*, to determine the design shear strength. Therefore:*

Equation 7-16 $V_{design} \leq 0.85V_n$

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The equations to determine V_c, V_s and V_p are:

Equation 7-17 $V_c = k\sqrt{f'_c}A_e$

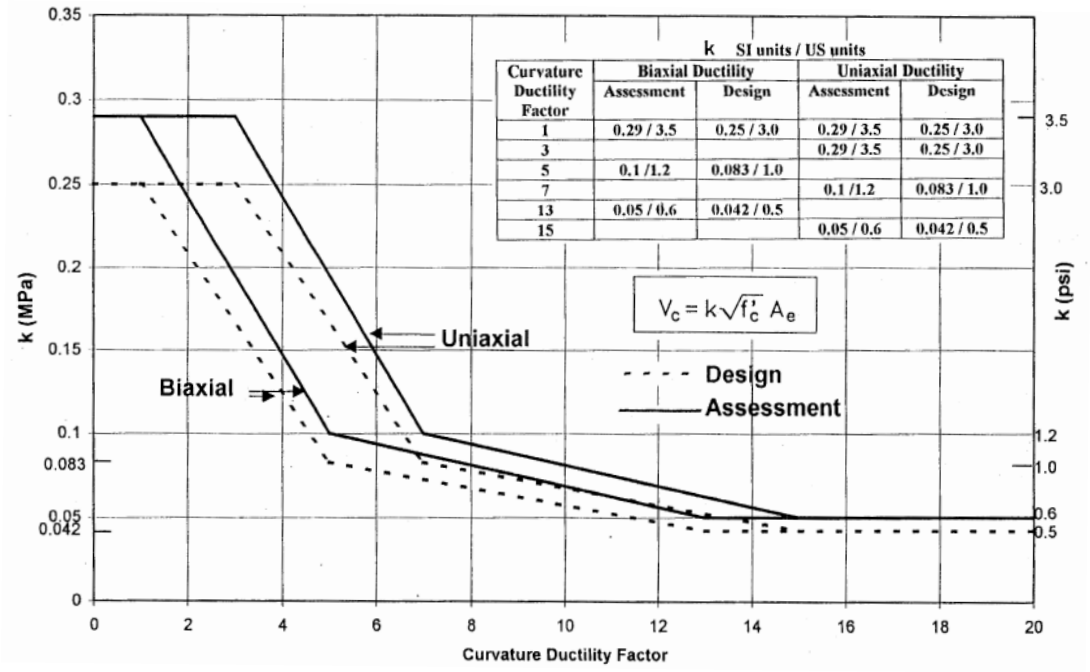
where:

k = factor dependent on the curvature ductility $\mu_\phi = \frac{\phi}{\phi_y}$, within the plastic hinge region, from Figure 31F-7-6. For regions greater than $2D_p$ (see Equation 7-18) from the plastic hinge location, the strength can be based on $m_f = 1.0$ (see Ferritto et. al. [7.2]).

f'_c = concrete compressive strength

$A_e = 0.8A_q$ is the effective shear area

FIGURE 31F-7-6—CONCRETE SHEAR MECHANISM
(from Fig. 3-30 of [7.2])



Circular spirals or hoops [7.2]:

Equation 7-18 $V_s = \frac{\frac{\pi}{2} A_{sp} f_{yh} (D_p - c - c_o) \cot(\theta)}{s}$

where:

A_{sp} = spiral or hoop cross section area

f_{yh} = yield strength of transverse or hoop reinforcement

D_p = pile diameter or gross depth (in case of a rectangular pile with spiral confinement)

c = depth from extreme compression fiber to neutral axis (N.A.) at flexural strength (see Figure 31F-7-7)

c_0 = distance from concrete cover to center of hoop or spiral (see Figure 31F-7-7)

θ = angle of critical crack to the pile axis (see Figure 31F-7-7) taken as 30° for existing structures, and 35° for new design

s = spacing of hoops or spiral along the pile axis

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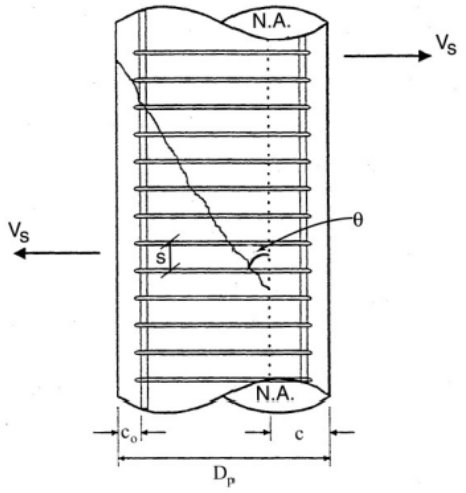
FIGURE 31F-7-7—TRANSVERSE SHEAR MECHANISM



Rectangular hoops or spirals [7.2]:

Equation 7-19 $$V_s = \frac{A_h f_{yh} (D_p - c - c_o) \cot(\theta)}{s}$$

where:

A_h = *total area of transverse reinforcement, parallel to direction of applied shear cut by an inclined shear crack*

Shear strength from axial mechanism, V_p *(see Figure 31F-7-8):*

Equation 7-20 $$V_p = \Phi (N_u + F_p) \tan \alpha$$

where:

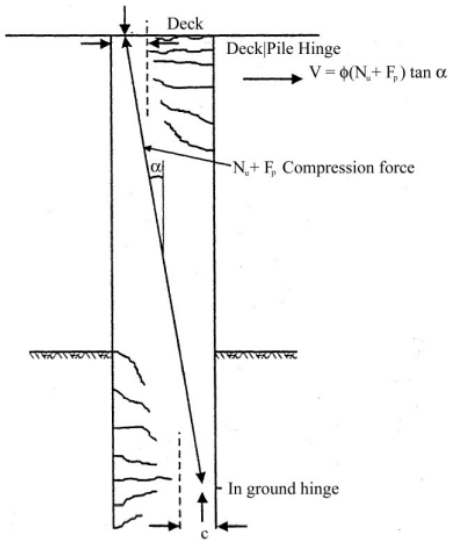
N_u = *external axial compression on pile including seismic load. Compression is taken as positive; tension as negative*

F_p = *prestress compressive force in pile*

α = *angle between line joining centers of flexural compression in the deck/pile and in-ground hinges, and the pile axis*

Φ = *1.0 for existing structures, and 0.85 for new design*

FIGURE 31F-7-8—AXIAL FORCE SHEAR MECHANISM



3107F.2.6 Steel piles.

3107F.2.6.1 General. *The capacity of steel piles is based on allowable strains corresponding to the desired performance criteria and design earthquake.*

3107F.2.6.2 Stability. *Section 3107F.2.5.2 applies to steel piles.*

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3107F.2.6.3 Plastic hinge length. *The plastic hinge length, L_p (above ground), for steel piles may be computed from Table 31F-7-6 for pile-to-deck connections.*

When the plastic hinge forms in-ground, the plastic hinge length may be determined using Equation (7-21) [7.5]:

Equation 7-21 $L_p = 2D$

where:

D = pile diameter

TABLE 31F-7-6—PLASTIC HINGE LENGTH FOR STEEL PILES [7.5]	
CONNECTION TYPE	**L_p AT DECK (in.)**
Embedded Pile	0.5D
Concrete Plug	$0.30 f_{ye} d_b$
Isolated Shell	$0.30 f_{ye} d_b + g$
Welded Embed	0.5D

d_b = diameter of the dowel (in.)
f_{ye} = design yield strength of dowel (ksi)
D = pile diameter (in.)
g = gap distance from bottom of the deck to edge of pipe pile or external confinement (in.)

3107F.2.6.4 Ultimate flexural strain capacity. *The following limiting value applies:*

Strain at extreme-fiber, $\varepsilon_u \leq 0.035$

3107F.2.6.5 Component acceptance/damage criteria. *The maximum allowable strain may not exceed the ultimate value defined in Section 3107F.2.6.4. Table 31F-7-7 provides limiting strain values for each performance level, for both new and existing structures.*

Steel components for noncompact hollow piles ($D_P/t < 0.07 \times E/f_y$) and for all nonseismic loading combinations shall be designed in accordance with AISC 325 [7.10].

TABLE 31F-7-7—STRUCTURAL STEEL STRAIN LIMITS, ε_u		
COMPONENTS	**LEVEL I**	**LEVEL 2**
Concrete Filled Pipe	0.008	0.030
Hollow Pipe	0.008	0.025

Level 1 or 2 refer to the seismic performance criteria (Section 3104F.2.1)

3107F.2.6.6 Shear design. *The procedures of Section 3107F.2.5.7, which are used to establish V_{design} are applicable to steel piles.*

The shear capacity shall be established from the AISC 325 [7.10]. For concrete filled pipe, Equation (7-15) may be used to determine shear capacity; however, V_{pile} must be substituted for V_s.

Equation 7-22 $V_{pile} = (\pi/2)\, t f_{y,\,pile}\, (D_p - c - c_o) \cot \theta$

where:

t = steel pile wall thickness

$f_{y,pile}$ = yield strength of steel pile

c_0 = distance from outside of steel pipe to center of hoop or spiral

[All other terms are as listed for Equation (7-18)].

3107F.2.7 Pile/deck connection strength.

3107F.2.7.1 Joint shear capacity. *The joint shear capacity shall be computed in accordance with ACI 318 [7.7]. For existing MOTs, the method [7.1, 7.2] given below may be used:*

1. *Determine the nominal shear stress in the joint region corresponding to the pile plastic moment capacity.*

Equation 7-23 $$v_j = \frac{0.9 M_o}{\sqrt{2}\, l_{dv}\, D_p^2}$$

where:

v_j = Nominal shear stress

M_o = Overstrength moment demand of the plastic hinge (the maximum possible moment in the pile) as determined from the procedure of Section 3107F.2.5.7.

l_{dv} = Vertical development length, see Figure 31F-7-9

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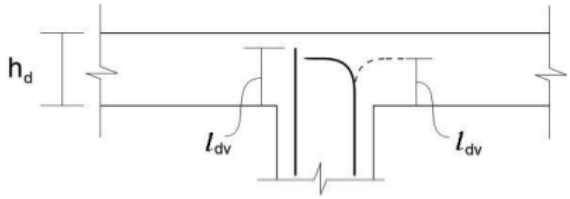
D_p = Diameter of pile

FIGURE 31F-7-9—DEVELOPMENT LENGTH



2. Determine the nominal principal tension p_t, stress in the joint region:

Equation 7-24 $$p_t = \frac{-f_a}{2} + \sqrt{\left(\frac{f_a}{2}\right)^2 + v_j^2}$$

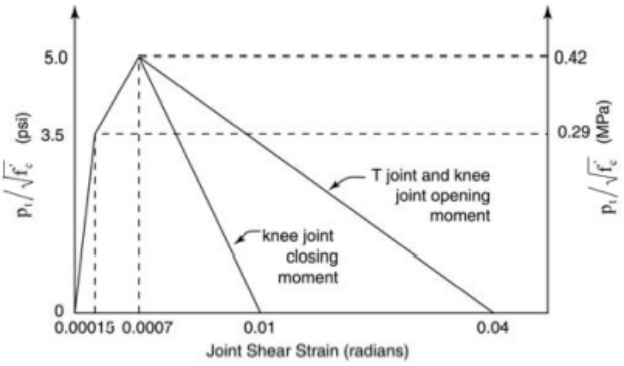
where:

Equation 7-25 $$f_a = \frac{N}{(D_p + h_d)^2}$$

is the average compressive stress at the joint center caused by the pile axial compressive force N and h_d is the deck depth. Note, if the pile is subjected to axial tension under seismic load, the value of N, and f_a will be negative.

If $p_t > 5.0\sqrt{f'_c}$, psi, joint failure will occur at a lower moment than the column plastic moment capacity M_p. In this case, the maximum moment that can be developed at the pile/deck interface will be limited by the joint principal tension stress capacity, which will continue to degrade as the joint rotation increases, as shown in Figure 31F-7-10. The moment capacity of the connection at which joint failure initiates can be established from Equations (7-27) and (7-28).

FIGURE 31F-7-10—DEGRADATION OF EFFECTIVE PRINCIPAL TENSION STRENGTH WITH JOINT SHEAR STRAIN (rotation) [7.1, pg. 564]



For $p_t = 5.0\sqrt{f'_c}$, determine the corresponding joint shear stress, v_j:

Equation 7-26 $$v_j = \sqrt{p_t(p_t - f_a)}$$

3. *The moment capacity of the connection can be approximated as:*

Equation 7-27 $$M_c = \left(\frac{1}{0.9}\right)\sqrt{2}v_j l_{dv} D_p^2 \le M_o$$

This will result in a reduced strength and effective stiffness for the pile in a pushover analysis. The maximum displacement capacity of the pile should be based on a drift angle of 0.04 radians.

If no mechanisms are available to provide residual strength, the moment capacity will decrease to zero as the joint shear strain increases to 0.04 radians, as shown in Figure 31F-7-11

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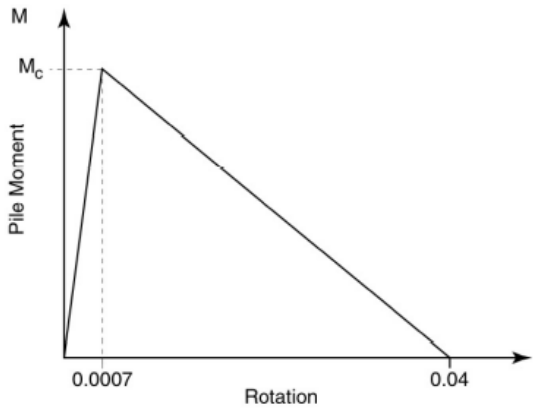
FIGURE 31F-7-11—REDUCED PILE MOMENT CAPACITY



If deck stirrups are present within $h_d/2$ of the face of the pile, the moment capacity, $M_{c,r}$, at the maximum plastic rotation of 0.04 radians may be increased from zero to the following (see Figure 31F-7-12):

Equation 7-28 $$M_{c,r} = 2A_s f_y(h_d - d_c) + N\left(\frac{D_p}{2} - d_c\right)$$

where:

A_s = *Area of slab stirrups on one side of joint*

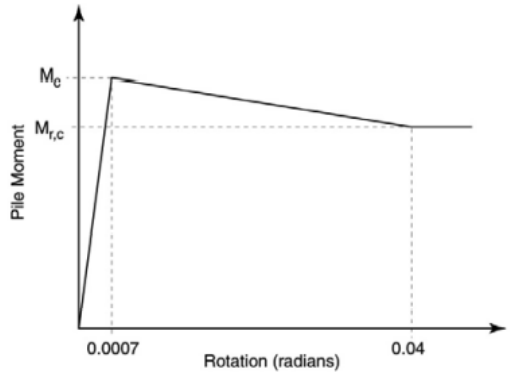
h_d = *See Figure 31F-7-9 (deck thickness)*

d_c = *Depth from edge of concrete to center of main reinforcement*

In addition, the bottom deck steel ($A_{s,\ deckbottom}$) area within $h_d/2$ of the face of the pile shall satisfy:

Equation 7-29 $$A_{s,\ deckbottom} \geq 0.5 \cdot A_s$$

FIGURE 31F-7-12—JOINT ROTATION



4. *Using the same initial stiffness as in Section 3107F.2.5.4, the moment-curvature relationship established for the pile top can now be adjusted to account for the joint degradation.*

The adjusted yield curvature, ϕ'_y, can be found from:

Equation 7-30 $$\phi'_y = \frac{\phi_y M_c}{M_p}$$

where:

M_p = *Idealized plastic moment capacity from Method A or B (see Figure 31F-7-4 or 31F-7-5, respectively)*

The plastic curvature, ϕ_p, corresponding to a joint rotation of 0.04 can be calculated as:

Equation 7-31 $$\phi_p = \frac{0.04}{L_p}$$

where:

L_p = *Plastic hinge length as determined from Equation (7-5)*

The adjusted ultimate curvature, ϕ'_u, can now be calculated as:

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Equation 7-32 $\phi'_u = \phi_p + \frac{\phi_y M_{c,r}}{M_p}$

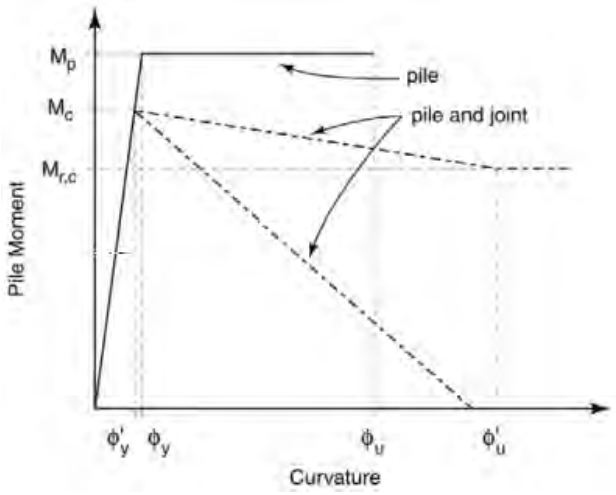
where:

M_p = *Idealized plastic moment capacity from Method A or B (see Figure 31F-7-4 or 31F-7-5, respectively)*

$M_{c,r}$ = *0, unless deck stirrups are present as discussed above.*

Examples of adjusted moment curvature relationships are shown in Figure 31F-7-13.

FIGURE 31F-7-13—EQUIVALENT PILE CURVATURE



3107F.2.7.2 Development length. *The minimum development length, l_{dc}, is:*

Equation 7-33 $l_{dc} \geq \frac{0.025 \cdot d_b \cdot f_{ye}}{\sqrt{f'_c}}$

where:

d_b = *dowel bar diameter*

f_{ye} = *expected yield strength of dowel*

f'_c = *compressive strength of concrete*

In assessing existing details, actual or estimated values for f_{ye} and f'_c rather than nominal strength should be used in accordance with Section 3107F.2.1.1.

When the development length is less than that calculated by the Equation (7-33), the moment capacity shall be calculated using a proportionately reduced yield strength, $f_{ye,r}$, for the vertical pile reinforcement:

Equation 7-34 $f_{ye,r} = f_{ye} \cdot \frac{l_d}{l_{dc}}$

where:

l_d = *actual development length*

f_{ye} = *expected yield strength of dowel*

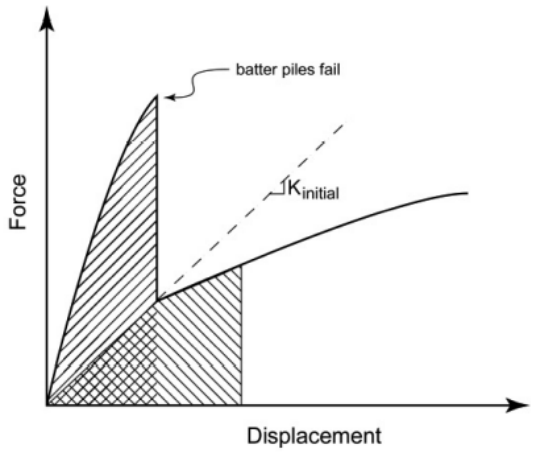
3107F.2.8 Batter piles.

3107F.2.8.1 Existing ordinary batter piles. *Wharves or piers with ordinary (not fused, plugged or having a seismic release mechanism) batter piles typically have a very stiff response when subjected to lateral loads in the direction of the batter. The structure often maintains most of its initial stiffness all the way to failure of the first row of batter piles. Since batter piles most likely will fail under a Level 2 seismic event, the following method may be used to evaluate the post-failure behavior of the wharf or pier:*

1. *Identify the failure mechanism of the batter pile-deck connection (refer to Section 3104F.4.7) for typical failure scenarios) and the corresponding lateral displacement.*
2. *Release the lateral load between the batter pile and the deck when the lateral failure displacement is reached.*
3. *Push on the structure until subsequent failure(s) have been identified.*

As an example, following these steps will result in a force-displacement (pushover) curve similar to the one shown in Figure 31F-7-14 for a wharf supported by one row of batter piles.

FIGURE 31F-7-14—PUSHOVER CURVE FOR ORDINARY BATTER PILES



When the row of batter piles fail in tension or shear, stored energy will be released. The structure will therefore experience a lateral displacement demand following the nonductile pile failures. If the structure can respond to this displacement demand without exceeding other structural limitations, it may be assumed that the structure is stable and will start to respond to further shaking with a much longer period and corresponding lower seismic demands. The wharf structure may therefore be able to sustain larger seismic demands following the loss of the batter piles than before the loss of pile capacity, because of a much softer seismic response.

The area under the pushover curve before the batter pile failures is compared to the equivalent area under the post failure pushover curve (refer to Figure 31F-7-14). If no other structural limitations are reached with the new displacement demand, it is assumed that the structure is capable of absorbing the energy. It should be noted that even though the shear failure is nonductile, it is expected that energy will be absorbed and the damping will increase during the damage of the piles. The above method is, therefore, considered conservative.

Following the shear failure of a batter pile row, the period of the structure increases such that equal displacement can be assumed when estimating the post-failure displacement demand. The new period may be estimated from the initial stiffness of the post-failure system as shown in Figure 31F-7-14. A new displacement demand can then be calculated in accordance with Section 3104F.2.

3107F.2.8.2 Nonordinary batter piles. *For the case of a plugged batter pile system, an appropriate displacement force relationship considering plug friction may be used in modeling the structural system.*

For fused and seismic release mechanism batter pile systems, a nonlinear modeling procedure shall be used and peer reviewed (Section 3101F.8.2).

3107F.2.9 Concrete pile caps with concrete deck. *Pile caps and decks are capacity protected components. Use the procedure of Section 3107F.2.5.7 to establish the over strength demand of the plastic hinges. Component capacity shall be based on nominal material strengths, and reduction factors according to ACI 318 [7.7].*

3107F.2.9.1 Component acceptance/damage criteria. *For new pile caps and deck, Level 1 seismic performance shall utilize the design methods in ACI 318 [7.7]; Level 2 seismic performance shall be limited to the following strains:*

Deck/pile cap: $\varepsilon_c \leq 0.005$

Reinforcing steel tension strain: $\varepsilon_S \leq 0.01$

For existing pile caps and deck, the limiting strain values are defined in Table 31F-7-5.

Concrete components for all nonseismic loading combinations shall be designed in accordance with ACI 318 [7.7].

3107F.2.9.2 Shear capacity (strength). *Shear capacity shall be based on nominal material strengths; reduction factors shall be in accordance with ACI 318 [7.7].*

3107F.2.10 Concrete detailing. *For new MOTs, the required development splice length, cover and detailing shall conform to ACI 318 [7.7], with the following exceptions:*

1. *For pile/deck dowels, the development length may be calculated in accordance with Section 3107F.2.7.2.*
2. *The minimum concrete cover for prestressed concrete piles shall be three inches, unless corrosion inhibitors are used, in which case a cover of two-and-one-half inches is acceptable.*
3. *The minimum concrete cover for wharf beams and slabs, and all concrete placed against soil shall be three inches, except for headed reinforcing bars (pile dowels or shear stirrups) the cover may be reduced to two-and-one-half inch cover at the top surface only. If corrosion inhibitors are used, a cover of two-and-one-half inches is acceptable.*

3107F.3 Timber piles and deck components.

3107F.3.1 Component strength. *The following parameters shall be established in order to assess component strength:*

New and existing components:

1. *Modulus of rupture*
2. *Modulus of elasticity*
3. *Type and grade of timber*

Existing components only:

1. *Original cross-section shape and physical dimensions*
2. *Location and dimension of braced frames*
3. *Current physical condition of members including visible deformation*
4. *Degradation may include environmental effects (e.g., decay, splitting, fire damage, biological and chemical attack) including its effect on the moment of inertia, I*
5. *Loading and displacement effects (e.g., overload, damage from earthquakes, crushing and twisting)*

Section 3104F.2.2 discusses existing material properties. At a minimum, the type and grade of wood shall be established. The adjusted reference design values per Section 6 of ANSI/AWC NDS [7.11] may be used.

For deck components, the adjusted design stresses shall be limited to the values of ANSI/AWC NDS [7.11]. Piling deformation limits shall be calculated based on the strain limits in accordance with Section 3107F.3.3.3.

The values shown in the ANSI/AWC NDS [7.11] are not developed specifically for MOTs and can be used as default properties only if as-built information is not available, the member is not damaged and testing is not performed. To account for the inherent uncertainty in establishing component capacities for existing structures with limited knowledge about the actual material properties, a reduction (knowledge) factor of k = 0.75 shall be included in the component strength and deformation capacity analyses in accordance with Section 3107F.2.1.2.

The modulus of elasticity shall be based on tests or Section 4 for deck components and Section 6 for timber piles of ANSI/AWC NDS [7.11].

3107F.3.2 Deformation capacity of flexural members. *The displacement demand and capacity of existing timber structures may be established per Section 3104F.2.*

The soil spring requirements for the lateral pile analysis shall be in accordance with Section 3106F.

A linear curvature distribution may be assumed along the full length of a timber pile.

The displacement capacity of a timber pile can then be established per Section 3107F.3.3.2.

3107F.3.3 Timber piles.

3107F.3.3.1 Stability. *Section 3107F.2.5.2 shall apply to timber piles.*

3107F.3.3.2 Displacement capacity. *A distinction shall be made between a pier-type pile, with a long unsupported length and a wharf-landside-type pile with a short unsupported length between the deck and soil. The effective length, L, is the distance between the pinned deck/pile connection and in-ground fixity as shown in Figure 31F-7-15. For pier-type (long unsupported length) vertical piles, three simplified procedures to determine fixity or displacement capacity are described in UFC 4-151-10 [7.12], UFC 3-220-01 [7.13] and Chai [7.14].*

In order to determine fixity in soft soils, another alternative is to use Table 31F-7-8.

The displacement capacity, Δ, for a pile pinned at the top, with effective length, L, (see Table 31F-7-8 and UFC 4-151-10 [7.12]), and moment, M, is:

Equation 7-35 $$\Delta = \frac{ML^2}{3EI}$$

where:

E = Modulus of elasticity

I = Moment of inertia

FIGURE 31F-7-15—ASSUMED IN-GROUND FIXITY

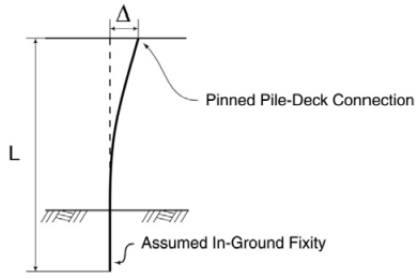


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TABLE 31F-7-8—DISTANCE BELOW GROUND TO POINT OF FIXITY		
PILE EI_g	SOFT CLAYS	LOOSE GRANULAR & MEDIUM CLAYS
$< 10^{10}$ lb in^2	10 feet	8 feet
$> 10^{10}$ lb in^2	12 feet	10 feet

Assuming linear curvature distribution along the pile, the allowable curvature, ϕ_a, can be established from:

Equation 7-36 $$\phi_a = \frac{\varepsilon_a}{c}$$

where:

ε_a *= allowable strain limit according to Section 3107F.3.3.3*

c = distance to neutral axis which can be taken as $D_p/2$, where D_p is the diameter of the pile

The curvature is defined as:

Equation 7-37 $$\phi = \frac{M}{EI}$$

The maximum allowable moment therefore becomes:

Equation 7-38 $$M = \frac{2\varepsilon_a}{D_p} EI$$

The displacement capacity is therefore given by:

Equation 7-39 $$\Delta = \frac{2\varepsilon_a L^2}{3D_p}$$

3107F.3.3.3 Component acceptance/damage criteria. *The following limiting strain values apply for each seismic performance level for existing structures:*

TABLE 31F-7-9—LIMITING STRAIN VALUES FOR TIMBER	
EARTHQUAKE LEVEL	MAX. TIMBER STRAIN
Level 1	0.002
Level 2	0.004

For new and alternatively, for existing structures ANSI/AWC NDS [7.11] may be used.

Timber components for all non-seismic loading combinations shall be designed in accordance with ANSI/AWC NDS [7.11].

3107F.3.3.4 Shear design. *To account for material strength uncertainties, the maximum shear demand, V_{max}, established from the single pile lateral analysis shall be multiplied by 1.2:*

Equation 7-40 $$V_{demand} = 1.2V_{max}$$

The factored maximum shear stress demand τ_{max}, in a circular pile can then be determined:

Equation 7-41 $$\tau_{max} = \frac{10}{9}\frac{V_{demand}}{\pi \cdot r^2}$$

where:

r = radius of pile

For the seismic load combinations, the maximum allowable shear stress, $\tau_{capacity}$, is the design shear strength, τ_{design}, from the ANSI/AWC NDS [7.11] multiplied by a factor of 2.8.

Equation 7-42 $$\tau_{capacity} = 2.8\tau_{design}$$

The shear capacity must be greater than the maximum demand.

3107F.4 Retaining structures. *Retaining structures constructed of steel or concrete shall conform to AISC 325 [7.10] or ACI 318 [7.7], respectively. For the determination of static and seismic loads on the sheet pile and sheet pile behavior, the following references are acceptable: Ebeling and Morrison [7.15], Strom and Ebeling [7.16], and PIANC TC-7 (Technical Commentary - 7) [7.17]. The applied loads and analysis methodology shall be determined by a California registered geotechnical engineer, and may be subject to peer review.*

3107F.5 Nonbuilding structures and building structures. *The analysis of nonbuilding structures and building structures shall be based on the load combinations defined in Section 3103F.8 with seismic assessment per Section 3104F.5. The component strength in nonbuilding structures and building structures shall be established in accordance with AISC [7.10], ACI-318 [7.7] and ANSI/AWC NDS [7.11], accounting for existing condition with knowledge factors applied, as appropriate. For strength evaluation of supports and attachments, see Section 3107F.7.*

3107F.6 Mooring and berthing components. *Mooring components include bitts, bollards, cleats, pelican hooks, capstans, mooring dolphins and quick release hooks. The maximum mooring line forces (demand) shall be established per Section 3105F. Applicable safety*

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factors to be applied to the demand are provided in Section 3105F.8. Multiple lines may be attached to the mooring component at varying horizontal and vertical angles. Mooring components shall therefore be checked for all mooring analysis load cases.

Berthing components include fender piles and fenders, which may be camels, fender panels or wales. The maximum berthing forces (demand) on breasting dolphins and fender piles shall be established according to Section 3105F.

Mooring and berthing components analyses shall be based on the load combinations defined in Section 3103F.8 with seismic assessment per Section 3104F.5. The component strength shall account for existing condition with knowledge factors applied, as appropriate. For strength evaluation of supports and attachments, see Section 3107F.7.

Mooring and berthing component capacities may be governed by the strength of the deck, structure and/or soil. Therefore, a check of the deck, structural and geotechnical capacities to withstand component loads shall be performed, as appropriate.

3107F.7 Supports and attachments (or anchorage). *The evaluation of supports and attachments for nonstructural components, nonbuilding structures and building structures shall be based on the load combinations defined in Section 3103F.8 with seismic assessment per Section 3104F.5. The strength of supports and attachments for nonstructural components, nonbuilding structures and building structures shall be assessed in accordance with AISC [7.10], ACI-318 [7.7] and ANSI/AWC NDS [7.11], accounting for existing condition with knowledge factors applied, as appropriate. The following parameters shall be established to calculate strength:*

New and existing components:

1. *Yield and tensile strength of structural steel*
2. *Structural steel modulus of elasticity*
3. *Yield and tensile strength of bolts*
4. *Concrete infill compressive strength*
5. *Concrete infill modulus of elasticity*

Additional parameters for existing components:

1. *Condition of steel including corrosion*
2. *Effective cross-sectional areas*
3. *Condition of embedment material such as concrete slab or timber deck*

The analysis and design shall include the load transfer to supporting deck/pile structures or foundation elements. A check of the deck capacity to withstand support and attachment loads shall be performed for all nonstructural components, nonbuilding structures and building structures.

3107F.8 Symbols.

A_e = *Effective shear area*

A_g = *Uncracked, gross section area*

A_h = *Total area of transverse reinforcement, parallel to direction of applied shear cut by an inclined shear crack*

A_s = *Area of slab stirrups on one side of joint*

$A_{s,\ deckbottom}$ = *Area of bottom deck steel*

A_{sp} = *Spiral or hoop cross section area*

c = *Depth from extreme compression fiber to neutral axis at flexural strength*

c_0 = *Distance from outside of steel pipe to center of hoop or spiral, or distance from concrete cover to center of hoop or spiral*

c_u = *Neutral axis depth at ultimate strength of section*

d_b = *Diameter of the longitudinal reinforcement, prestressing strand or dowel, as appropriate*

d_c = *Depth from edge of concrete to center of main reinforcement*

d_{st} = *Diameter of the prestressing strand (in)*

D = *Pile diameter or least cross-sectional dimension*

D_p = *Pile diameter or gross depth (in case of a rectangular pile with spiral confinement)*

e = *Eccentricity of axial load*

ε_a = *Allowable strain limit*

ε_c = *Concrete compressive strain*

ε_{cm} = *Maximum extreme fiber compression strain*

ε_{cu} = *Ultimate concrete compressive strain*

ε_p = *Prestressing steel tension strain*

ε_s = *Reinforcing steel tension strain*

ε_{sm} = *Strain at peak stress of confining reinforcement*

ε_u = *Ultimate steel strain*

E = *Modulus of elasticity*

E_c = *Modulus of elasticity for concrete*

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E_s = Modulus of elasticity for steel

f'_c = Concrete compression strength

f'_{cc} = Confined strength of concrete

F_p = Prestress compression force in pile

f_p = Yield strength of prestressing strand

f_{pye} = Design yield strength of prestressing strand (ksi)

f_y = Yield strength of steel

f_{ye} = Design yield strength of longitudinal reinforcement, prestressing strand or dowel, as appropriate (ksi)

f_{yh} = Yield stress of confining steel

f_{yh} = Yield strength of transverse or hoop reinforcement

$f_{y,pile}$ = Yield strength of steel pile

$f_{ye,r}$ = Reduced dowel yield strength

g = Gap distance from bottom of the deck to edge of pipe pile or external confinement (in.)

h = Width of pile in considered direction

h_d = Deck depth

I = Moment of inertia

I_c = Moment of inertia of uncracked section

I_e = Effective moment of inertia

I_g = Gross moment of inertia

I_s = Moment of inertia for steel section

k = Factor dependent on the curvature ductility $\mu_\phi = \phi/\phi_y$, within the plastic hinge region

k = Knowledge factor

L = Distance from the critical section of the plastic hinge to the point of contraflexure (Section 3107F.2.5.3), or effective length (Section 3107F.3.3.2)

L_p = Plastic hinge length

l_{dc} = Minimum development length

l_d = Actual development length

l_{dv} = Vertical development length

M = Maximum allowable moment

M_c = Moment capacity of the connection

$M_{c,r}$ = Moment capacity at maximum plastic rotation

M_o = Overstrength moment demand of the plastic hinge (Section 3107F.2.7)

M_p = Idealized plastic moment capacity from Method A or B (Section 3107F.2.5)

M_y = Moment at first yield

N = Pile axial compressive force

N_u = External axial compression on pile including seismic load

ρ_s = Effective volume ratio of confining steel

p_t = Nominal principal tension

r = Radius of circular pile

s = Spacing of hoops or spiral along the pile axis

t = Steel pile wall thickness

Δ = Displacement capacity

θ = Angle of critical crack to the pile axis

θ_p = Plastic rotation

α = Angle between line joining centers of flexural compression in the deck/pile and in-ground hinges, and the pile axis

ϕ_a = Allowable curvature

ϕ_m = Maximum curvature

ϕ_p, $\phi_{p,m}$ = Plastic curvature

ϕ_u = Ultimate curvature

ϕ'_u = Adjusted ultimate curvature

ϕ_y = *Yield curvature*

ϕ'_y = *Adjusted yield curvature*

$\tau_{capacity}$ = *Maximum allowable shear stress*

τ_{design} = *Design shear strength*

τ_{max} = *Maximum shear stress*

V_c = *Concrete shear strength*

v_j = *Nominal joint shear stress*

V_{design} = *Design shear strength*

V_{max} = *Maximum shear demand*

V_n = *Nominal shear strength*

V_p = *Contribution to shear strength from axial loads*

V_s = *Transverse reinforcement shear strength*

V_{pile} = *Shear strength of steel pile*

3107F.9 References.

[7.1] Priestley, M.J.N, Seible, F. and Calvi, G.M. "Seismic Design and Retrofit of Bridges," 1996, New York.

[7.2] Ferritto, J., Dickenson, S., Priestley N., Werner, S., Taylor, C., Burke D., Seelig W., and Kelly, S., 1999, "Seismic Criteria for California Marine Oil Terminals, Vol.1 and Vol.2," Technical Report TR-2103-SHR, Naval Facilities Engineering Service Center, Port Hueneme, CA.

[7.3] American Society of Civil Engineers (ASCE), 2017, ASCE/SEI 41-17 (ASCE/SEI 41), "Seismic Evaluation and Retrofit of Existing Buildings," Reston, VA.

[7.4] Blakeley, J.P., Park, R., "Prestressed Concrete Sections with Cyclic Flexure," Journal of the Structural Division, American Society of Civil Engineers, Vol. 99, No. ST8, August1973, pp. 1 71 7-1 742, Reston, VA.

[7.5] American Society of Civil Engineers (ASCE), 2014, ASCE/COPRI 61-14 (ASCE/COPRI 61), "Seismic Design of Piers and Wharves," Reston, VA.

[7.6] Port of Long Beach (POLB), 2012 February 29, "Wharf Design Criteria," Version 3.0, Long Beach, CA.

[7.7] American Concrete Institute (ACI), 2014, ACI 318-14 (ACI 318), "Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)," Farmington Hills, MI.

[7.8] Applied Technology Council (ATC), 1996, ATC-32, "Improved Seismic Design Criteria for California Bridges: Provisional Recommendations," Redwood City, CA.

[7.9] Kowalski, M.J. and Priestley, M.J.N., June 1998, "Shear Strength of Ductile Bridge Columns," Proc. 5th Caltrans Seismic Design Workshop, Sacramento, CA.

[7.10] American Institute of Steel Construction Inc. (AISC), 2017, AISC 325-17 (AISC 325), "Steel Construction Manual," 15th ed., Chicago, IL.

[7.11] American Wood Council (AWC), 2017, ANSI/AWC NDS-2018 (ANSI/AWC NDS) "National Design Specification (NDS) for Wood Construction," Washington, D.C.

[7.12] Department of Defense, 10 September 2001 (Revised 1 September 2012), Unified Facilities Criteria (UFC) 4-151-10, "General Criteria for Waterfront Construction," Washington, D.C.

[7.13] Department of Defense, 01 November 2012, Unified Facilities Criteria (UFC) 3-220-01, "Geotechnical Engineering," Washington, D.C.

[7.14] Chai, Y.H., "Flexural Strength and Ductility of Extended Pile-Shafts, I: Analytical Model," Journal of Structural Engineering, May 2002, pp. 586–594.

[7.15] Ebeling, Robert M. and Morrison, Ernest E., Jr., November 1992, "The Seismic Design of Waterfront Retaining Structures", U.S. Army Technical Report ITL-92-11/U.S. Navy Technical Report NCEL TR 939, Dept. of Army, Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

[7.16] Strom, Ralph W. and Robert M. Ebeling, December 2001,"State of the Practice in the Design of Tall, Stiff, and Flexible Tieback Retaining Walls," Information Technology Laboratory, Engineer Research and Development Center, U.S. Army Corps of Engineers, Vicksburg, MS.

[7.17] Permanent International Association of Navigation Congresses (PIANC), "Seismic Design Guidelines for Port Structures," Technical Commentary-7, Working Group No. 34 of the Maritime Navigation Commission International Navigation Association, A.A. Balkema, Lisse, Netherlands. 2001.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 8

SECTION 3108F—FIRE PREVENTION, DETECTION AND SUPPRESSION

3108F.1 General. *This section provides minimum standards for fire prevention, detection and suppression at MOTs. See Section 3101F.3 for definitions of "new" (N) and "existing" (E).*

3108F.2 Hazard assessment and risk analysis.

3108F.2.1 Fire hazard assessment and risk analysis (N/E). *A fire hazard assessment and risk analysis shall be performed, considering the loss of commercial power, earthquake and other relevant events.*

3108F.2.2 Fire Protection Assessment (N/E). *A site-specific Fire Protection Assessment shall be prepared by a registered engineer or a competent fire protection professional. The assessment shall consider the hazards and risks identified per Section 3108F.2.1 and shall include, but not be limited to, the elements of pre-fire planning as discussed in Section 9 of API RP 2001 [8.1] and Chapter 19 of ISGOTT [8.2]. MOT operational and training requirements, as related to fire protection, shall be considered (see 2 CCR 2385 [8.3]). The Fire Protection Assessment shall include goals, resources, organization, strategy and tactics, including the following:*

1. *MOT characteristics (e.g., tanker/manifold, product pipelines, etc.)*
2. *Product types and fire scenarios, including products not regulated by the Division that may impact development of fire scenarios*
3. *Possible collateral fire damage to adjacent facilities*
4. *Firefighting capabilities, including availability of water (flow rates and pressure), foam type and associated shelf life, proportioning equipment and vehicular access*
5. *The selection of appropriate extinguishing agents*
6. *Calculation of water and foam capacities, as applicable, consistent with area coverage requirements*
7. *Coordination of emergency efforts*
8. *Emergency escape routes*
9. *Requirements for fire drills, training of personnel, and the use of equipment*
10. *Life safety*
11. *Rescue for terminal and vessel personnel*
12. *Cooling water for pipelines and valves exposed to the heat*
13. *Contingency planning when supplemental fire support is not available. Mutual aid agreements can apply to water and land based support.*
14. *Consideration of adverse conditions, such as electrical power failure, steam failure, fire pump failure, an earthquake or other damage to the fire water system.*

The audit team shall review and field verify the firefighting equipment locations and condition to ensure operability.

3108F.2.3 Cargo liquid volatility ratings and fire hazard classifications (N/E). *The cargo liquid volatility ratings are defined in Table 31F-8-1, as either High (H_C) or Low (L_C), depending on the flash point.*

Fire hazard classifications (Low, Medium or High) are defined in Table 31F-8-2, and are based on the cargo liquid volatility ratings and the sum of all stored and flowing volumes (V_T), prior to the emergency shutdown (ESD) system stopping the flow of oil.

The stored (V_S) volume is the sum of the H_C and L_C volumes (V_{SH} and V_{SL}, respectively).

During a leak, a quantity of oil is assumed to spill at the maximum cargo flow rate until the ESD is fully effective. The ESD valve closure time shall conform with 2 CCR 2380 [8.3]. The flowing volume (V_F), calculated in Equation (1-1), is the sum of the H_C and L_C liquid volumes (V_{FH} and V_{FL}, respectively).

TABLE 31F-8-1—CARGO LIQUID VOLATILITY RATINGS

VOLATILITY RATING	CRITERION	REFERENCE	EXAMPLES
Low (L_C)	Flash Point[1] ≥ 140°F	ISGOTT (Chapter 1), [8.2] —Nonvolatile	#6 Heavy Fuel Oil, residuals, bunker
High (H_C)	Flash Point[1] < 140°F	ISGOTT (Chapter 1), [8.2] —Volatile	Gasoline, JP4, crude oils

1. Flash Point is defined per ISGOTT [8.2].

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TABLE 31F-8-2—FIRE HAZARD CLASSIFICATIONS						
FIRE HAZARD CLASSIFICATION	STORED VOLUME (bbls)			FLOWING VOLUME (bbls)		CRITERIA (bbls)*
	Stripped	V_{SL}	V_{SH}	V_{FL}	V_{FH}	
LOW	y	n	n	y	y	$V_{FL} \geq V_{FH}$, and $V_T \leq 1200$
LOW	n	y	n	y	n	$V_{SL} + V_{FL} \leq 1200$
MEDIUM	n	n	y	n	y	$V_{SH} + V_{FH} \leq 1200$
MEDIUM	y	n	n	y	y	$V_{FH} > V_{FL}$, and $V_T \leq 1200$
HIGH	y	n	n	y	y	$V_T > 1200$
HIGH	n	y	y	y	y	$V_T > 1200$
HIGH	n	y	n	y	n	$V_{SL} + V_{FL} > 1200$
HIGH	n	n	y	n	y	$V_{SH} + V_{FH} > 1200$

y = yes
n = no
Stripped = product purged from pipeline following product transfer event.
V_{SL} = stored volume of low volatility product
V_{SH} = stored volume of high volatility product
V_{FL} = volume of low volatility product flowing through transfer line during ESD.
V_{FH} = volume of high volatility product flowing through transfer line during ESD.
$V_T = V_{SL} + V_{SH} + V_{FL} + V_{FH}$ = Total Volume (stored and flowing)
* Quantities are based on maximum flow rate, including simultaneous transfers.

3108F.3 Fire prevention.

3108F.3.1 Ignition source control.

3108F.3.1.1 *Protection from ignition by static electricity, lightning or stray currents shall be in accordance with API RP 2003 [8.4](N/E).*

3108F.3.1.2 *Requirements to prevent electrical arcing shall be in conformity with 2 CCR 2341 [8.3] (N/E).*

3108F.3.1.3 *Multi-berth terminal piers shall be constructed so as to provide a minimum of 100 ft between adjacent manifolds (N).*

3108F.3.2 Emergency shutdown (ESD) systems. *Emergency shutdown systems are essential to oil spill and fire prevention. These systems may include, but are not limited to, ESD valves, shore isolation valves (SIVs), automatic pump shutdown, controls, actuators and alarms. The ESD systems shall conform to 2 CCR 2380 [8.3] and 33 CFR 154.550 [8.5], and provide:*

1. *Remote actuation stations strategically located, so that ESD valve(s) may be shut within required times (N).*
2. *Multiple actuation stations installed at strategic locations, so that one such station is located more than 100 ft from areas classified as Class I, Group D, Division 1 or 2 per the California Electrical Code [8.6]. Actuation stations shall be wired in parallel to achieve redundancy and arranged so that fire damage to one station will not disable the ESD system (N).*
3. *Communications or control circuits to synchronize simultaneous closure of the shore isolation valves (SIVs) with the shutdown of loading pumps (N).*
4. *A manual reset to restore the ESD system to an operational state after each initiation (N).*
5. *An alarm to indicate failure of the primary power source (N).*
6. *A secondary (emergency) power source (N).*
7. *Periodic testing of the system (N/E).*
8. *Fire proofing of motors and control-cables that are installed in areas classified as Class I, Group D, Division 1 or 2 per the California Electrical Code [8.6]. Fire proofing shall, at a minimum, comply with the recommendations in Section 6 of API RP 2218 [8.7] (N).*

3108F.3.2.1 Emergency shutdown (ESD) valves. *ESD valves shall conform to the requirements in Section 3109F.5, as applicable, and the following:*

1. *Be located near the dock manifold connection or loading arm (N/E).*
2. *Have "Local" and "Remote" actuation capabilities (N).*

3108F.3.2.2 Shore isolation valves (SIVs). *Shore isolation valve(s) shall conform to the requirements in Section 3109F.5, as applicable, and the following:*

1. *Be located onshore for each cargo pipeline. All SIVs shall be clustered together, for easy access (N).*
2. *Be clearly identified together with associated pipeline (N/E).*
3. *Have adequate lighting (N/E).*
4. *Be provided with communications or control circuits to synchronize simultaneous closure of the ESD system with the shutdown of loading pumps (N).*

5. *Have a manual reset to restore the SIV system to an operational state after each shut down event (N).*
6. *Be provided with thermal expansion relief to accommodate expansion of the liquid when closed. Thermal relief piping shall be properly sized and routed around the SIV, into the downstream segment of the pipeline or into other containment (N/E).*
7. *SIVs installed in pipelines carrying H_C liquids, or at a MOT with a spill classification "Medium" or "High" (see Table 31F-1-1), shall be equipped with "Local" and "Remote" actuation capabilities. Local control SIVs may be motorized and/or operated manually (N).*

3108F.4 Automated fire detection system. *An MOT shall have a permanently installed automated fire detection or sensing system (N).*

Fire detection systems shall be tested and maintained per the manufacturer or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

3108F.5 Fire alarms. *Automatic and manual fire alarms shall be provided at strategic locations. The fire alarm system shall be arranged to provide a visual and audible alarm that can be readily discerned by all personnel at the MOT and vessel personnel involved in the transfer operations. Additionally, visual and audible alarms shall be displayed at the MOT's control center (N/E).*

If the fire alarm system is integrated with the ESD system, the operation shall be coordinated with the closure of SIVs, block valves and pumps to avoid adverse hydraulic conditions (N/E).

Fire alarms shall be tested and maintained in accordance with NFPA 72 [8.8] or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

3108F.6 Fire suppression. *Table 31F-8-3 gives the minimum provisions for fire-water flow rates and fire extinguishers. The table includes consideration of the fire hazard classification (Low, Medium or High), the cargo liquid volatility rating (Low or High) and the vessel or barge size. The minimum provisions may have to be augmented for multi-berth terminals or those conducting simultaneous transfers, in accordance with the risks identified in the Fire Protection Assessment. For fire water and foam piping and fittings, see Section 3109F.7.*

TABLE 31F-8-3—MINIMUM FIRE SUPPRESSION PROVISIONS (N/E)

FIRE HAZARD CLASSIFICATION (From Table 31F-8-2)	***VESSEL AND CARGO LIQUID VOLATLITY RATING (From Table 31F-8-1)***	***MINIMUM PROVISIONS***
LOW	*Barge with L_C (including drums)*	***500 gpm of water*** *2 x 20 lb portable dry chemical extinguishers or the equivalent.* *2 x 110 lb wheeled dry chemical extinguishers or the equivalent.*
	Barge with H_C (including drums) *Tankers < 50 KDWT, handling L_C or H_C*	***1,500 gpm of water*** *2 x 20 lb portable dry chemical extinguishers or the equivalent.* *2 x 165 lb wheeled dry chemical extinguishers or the equivalent*
MEDIUM	*Tankers < 50 KDWT handling L_C*	***1,500 gpm of water*** *2 x 20 lb portable dry chemical extinguishers or the equivalent.* *2 x 165 lb wheeled dry chemical extinguishers or the equivalent.*
	Tankers < 50 KDWT, handling H_C	***2,000 gpm of water*** *4 x 20 lb portable dry chemical extinguishers or the equivalent.* *2 x 165 lb wheeled dry chemical extinguishers or the equivalent.*
HIGH	*Tankers < 50 KDWT, handling L_C or H_C*	***3,000 gpm of water*** *4 x 20 lb portable dry chemical extinguishers or the equivalent.* *2 x 165 lb wheeled dry chemical extinguishers or the equivalent.*
LOW, MEDIUM, HIGH	*Tankers > 50 KDWT, handling L_C or H_C*	***3,000 gpm of water*** *6 x 20 lb portable dry chemical extinguishers or the equivalent.* *4 x 165 lb wheeled dry chemical extinguishers or the equivalent.*

Notes: L_C and H_C are defined in Table 31F-8-1. KDWT = Dead Weight Tons (Thousands)

3108F.6.1 Coverage (N/E). *The fire suppression system shall provide coverage for:*

1. *Marine structures including the pier/wharf and approach trestle*
2. *Terminal cargo manifold*
3. *Cargo transfer system including loading arms, hoses and hose racks*
4. *Vessel manifold*
5. *Sumps*
6. *Pipelines*
7. *Control stations*

3108F.6.2 Fire hydrants. *Hydrants shall be located not greater than 150 ft apart, along the wharf and not more than 300 ft apart on the approach trestle [8.2] (N).*

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Additional hose connections shall be provided at the base of fixed monitors and upstream of the water and foam isolation valves. Connections shall be accessible to fire trucks or mutual aid equipment as identified in the Fire Protection Assessment (N/E).

Hydrants and hoses shall be capable of applying two independent water streams covering the cargo manifold, transfer system, sumps and vessel manifold (N/E).

3108F.6.3 Fire water. *The source of fire water shall be reliable and provide sufficient rated capacity as determined in the Fire Protection Assessment. Water-based fire protection systems shall be tested and maintained per California NFPA 25 [8.9], as adopted and amended by the State Fire Marshal, or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).*

1. *All wet systems shall be kept pressurized (jockey pump or other means) (N/E).*
2. *Wet system headers shall be equipped with a low-pressure alarm wired to the control room (N).*
3. *Fire pumps shall be installed at a distance of at least 100 ft from the nearest cargo manifold area (N).*
4. *Hose connections for fireboats or tugboats shall be provided on the MOT fire water line, and at least one connection shall be an international shore fire connection at each berth [8.2]. Connections shall be installed at a safe access distance from the sumps, manifolds and loading arms (N/E).*

3108F.6.4 Foam supply (N/E). *Product flammability, foam type, water flow rates and application duration shall be considered in foam supply calculations.*

Fixed foam proportioning equipment shall be located at a distance of at least 100 ft from the sumps, manifolds and loading arms, except where hydraulic limits of the foam delivery system require closer proximity.

MOTs shall have a program to ensure that foam is replaced according to the manufacturer's recommendations.

3108F.6.5 Fire monitor systems. *Fire monitors shall be located to provide coverage of MOT cargo manifolds, loading arms, hoses and vessel manifold areas. This coverage shall provide at least two independent streams of water/foam. Monitors shall be located to provide an unobstructed path between the monitor and the target area (N/E).*

If the vessel manifold is more than 30 ft above the wharf deck, the following factors shall be considered, in order to determine if monitors located on elevated masts or towers are required (N/E):

1. *Maximum tanker freeboard*
2. *Tidal variations*
3. *Pier/wharf/loading platform elevation*
4. *Winds*
5. *Fire water line pressure*

Sprinklers and/or remotely controlled water/foam monitors shall be installed to protect personnel, escape routes, shelter locations and the fire water system (N).

Isolation valves shall be installed in the fire water and the foam lines in order to segregate damaged sections without disabling the entire system. Readily accessible isolation valves shall be installed 100–150 ft from the manifold and the loading arm/hose area (N).

3108F.6.6 Supplemental fire suppression systems (E). *A supplemental system is an external waterborne or land- based source providing suppressant and equipment. Supplemental systems may not provide more than one-quarter of the total water requirements specified in the Fire Protection Assessment.*

Additionally, supplementary systems shall not be considered in a Fire Protection Assessment, unless available within 20 minutes following the initiation of a fire alarm. Mutual aid may be considered as part of the supplemental system.

3108F.7 Fire systems seismic assessment (N/E). *Fire detection and protection systems, and emergency shutdown systems shall have a seismic assessment per Section 3104F.5. For strength evaluation of supports and attachments, see Section 3107F.7.*

For firewater piping and pipeline systems, see Section 3109F.7.

3108F.8 References.

[8.1] American Petroleum Institute (API), 2012, API Recommended Practice 2001 (API RP 2001), "Fire Protection in Refineries," 9th ed., Washington, D.C.

[8.2] International Chamber of Shipping (ICS), Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors (IAPH), 2006, "International Safety Guide for Oil Tankers and Terminals (ISGOTT)," 5th ed., Witherby, London.

[8.3] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)

[8.4] American Petroleum Institute (API), 2008, API Recommended Practice 2003 (API RP 2003), "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents," 7th ed., Washington, D.C.

[8.5] Code of Federal Regulations (CFR), Title 33, Section 154.550 – Emergency Shutdown (33 CFR 154.550)

[8.6] California Code of Regulations (CCR), Title 24, Part 3, California Electrical Code (Article 500),

[8.7] American Petroleum Institute (API), 2013, API Recommended Practice 2218 (API RP 2218), "Fireproofing Practices in Petroleum and Petrochemical Processing Plants," 3rd ed., Washington, D.C.

[8.8] National Fire Protection Association (NFPA), NFPA 72, "National Fire Alarm and Signaling Code," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.

[8.9] National Fire Protection Association (NFPA), California NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," California ed., Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 9

SECTION 3109F—PIPING AND PIPELINES

3109F.1 General. *This section provides minimum engineering standards for piping, pipelines, valves, supports and related appurtenances at MOTs. This section applies to piping and pipelines used for transferring:*

1. *Oil (see Section 3101F.1) to or from tank vessels or barges*
2. *Oil within the MOT*
3. *Vapors, including Volatile Organic Compounds (VOCs)*
4. *Inerting or enriching gases to vapor control systems*

Additionally, it also applies to piping or pipelines providing services, which includes stripping, sampling, venting, vapor control and fire water.

See Section 3101F.3 for definitions of "new" (N) and "existing" (E).

3109F.2 Oil piping and pipeline systems. *All pressure piping and pipelines for oil service shall conform to the provisions of API Standard 2610 [9.1], ASME B31.3 [9.2] or B31.4 [9.3] as appropriate, including the following:*

1. *All piping/pipelines shall be documented on current P&IDs (N/E).*
2. *Piping and pipeline systems shall be installed above deck (N).*
3. *The systems shall be arranged in a way not to obstruct access to and removal of other piping components and equipment (N).*
4. *Flexibility shall be achieved through adequate expansion loops or joints (N/E).*
5. *A guide or lateral restraint shall be provided just past the elbow where a pipe changes direction in order to minimize excessive axial stress (N).*
6. *Piping shall be routed to allow for movement due to thermal expansion and seismic displacement, without exceeding the allowable stresses in the supports, and anchor connections (see Section 3109F.3) (N/E).*
7. *Plastic piping shall not be used unless designated for oil service (N/E).*
8. *If a flanged connection exists within 20 pipe diameters from the end of any replaced section, the pipe shall be replaced up to and including the flange.*
9. *Pipelines shall be seamless, electric-resistance-welded or electric-fusion-welded (N).*
10. *Piping greater than 2 inches in diameter shall be butt-welded. Piping 2 inches and smaller shall be socket welded or threaded.*
11. *Pipeline connections directly over the water shall be welded (N). Flanged connections not over water shall have secondary containment (N).*
12. *Pipelines that do not have a valid and certified Static Liquid Pressure Test (SLPT) [9.4] shall be marked "OUT OF SERVICE." Out-of-service piping and pipelines shall be purged, gas-freed and physically isolated from sources of oil.*
13. *If a pipeline is "out-of-service" for 3 or more years, it will require a valid and certified Static Liquid Pressure Test (SLPT) and API 570 inspection [9.4] prior to Division approval for re-use (E).*
14. *New piping and pipeline systems require a valid and certified Static Liquid Pressure Test (SLPT) [9.4] and Division approval, prior to operation.*

3109F.3 Pipeline stress analysis (N/E). *Pipeline stress analysis shall be performed for:*

1. *New piping and pipelines*
2. *Significant rerouting/relocation of existing piping*
3. *Any replacement of "not in-kind" piping*
4. *Any significant rearrangement or replacement of "not in-kind" anchors and/or supports*
5. *Significant seismic displacements calculated from the structural and/or geotechnical assessments*

Pipeline stress analysis shall be performed in accordance with ASME B31.4 [9.3], considering all relevant loads and corresponding displacements determined from the structural analysis and/or geotechnical analysis described in Sections 3104F and 3106F, respectively. Seismic loading of above-grade pipelines may be analyzed in accordance with ASME B31.E [9.5] with seismic loads computed from Section 3104F.5.4.1.

For pipelines spanning between seismically isolated structures (Section 3104F.1.3) and/or varying geotechnical conditions, evaluation of the relative movement of pipelines and supports and varying seismic accelerations shall be considered, including phase differences.

Flexibility analysis for piping, considering supports, shall be performed in accordance with ASME B31.4 [9.3] by using the largest temperature differential imposed by normal operation, start-up, shutdown or abnormal conditions. Thermal loads shall be based upon maximum and minimum local temperatures; heat traced piping shall use the maximum attainable temperature of the heat tracing system.

Section 3106F.12 provides additional considerations for underwater seafloor pipelines.

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To determine forces at sliding surfaces, the coefficients of static friction shown in Table 31F-9-1 shall be used.

TABLE 31F-9-1—COEFFICIENTS OF STATIC FRICTION	
SLIDING SURFACE MATERIALS	**COEFFICIENT OF STATIC FRICTION**
Teflon on Teflon	0.10
Plastic on Steel	0.35
Steel on Steel	0.40
Steel on Concrete	0.45
Steel on Timber	0.49

3109F.4 Piping and pipelines supports and attachments (or anchorage). *Supports and attachments shall conform to ASME B31.3 [9.2], ASME B31.4 [9.3], API Standard 2610 [9.1] and the ASCE Guidelines [9.6] (N).*

A seismic assessment shall be performed for existing supports and attachments using recommendations in Section 7 of CalARP [9.7], as appropriate (E).

For strength evaluation of supports and attachments, see Section 3107F.7. If a pipeline analysis has been performed and support reactions are available, they may be used to determine the forces on the support structure.

3109F.5 Appurtenances.

3109F.5.1 Valves and fittings. *Valves and fittings shall meet the following requirements:*

1. *Conform to ASME B31.3 [9.2], ASME B31.4 [9.3], API Standard 609 [9.8] and ASME B16.34 [9.9], as appropriate, based on their service (N).*
2. *Conform to Section 10 of API Standard 2610 [9.1] (N/E).*
3. *Stems shall be oriented in a way not to pose a hazard in operation or maintenance (N/E).*
4. *Nonductile iron, cast iron and low-melting temperature metals shall not be used in any hydrocarbon service (N/E).*
5. *Double-block and bleed valves shall be used for manifold valves (N/E).*
6. *Isolation valves shall be fire-safe in accordance with API Standard 607 [9.10] (N).*
7. *Swing check valves shall not be installed in vertical down-flow piping (N/E).*
8. *Pressure relief devices shall be used in any closed piping system that has the possibility of being over pressurized due to temperature increase (thermal relief valves) (N/E).*
9. *Pressure relief devices shall be used in any piping system that has the possibility of being over pressurized due to surging, considering all plausible normal and abnormal operational scenarios in accordance with ASME B31.4 [9.3] (N/E).*
10. *Pressure relief devices shall be sized in accordance with API RP 520 [9.11] (N). Set pressures and accumulating pressures shall be in accordance with API RP 520 [9.11] (N/E).*
11. *Discharge from pressure relief valves shall be directed into lower pressure piping for recycling or proper disposal. Discharge shall never be directed into the open environment, unless secondary containment is provided (N/E).*
12. *Threaded, socket-welded, flanged and welded fittings shall conform to Section 8 of API Standard 2610 [9.1] (N/E).*
13. *ESD valves and SIVs shall also conform to the requirements of Sections 3108F.3.2.1 and 3108F.3.2.2.*

3109F.5.2 Valve actuators (N/E).

1. *Actuators shall have a readily accessible, manually operated overriding device to operate the valve during a power loss.*
2. *Torque switches shall be set to stop the motor closing operation at a specified torque setting.*
3. *Limit switches shall be set to stop the motor opening operation at a specified limit switch setting.*
4. *Critical valves shall be provided with thermal insulation. The insulation shall be inspected and maintained at periodic intervals. Records of thermal insulation inspections and condition shall be maintained for at least 6 years.*
5. *Electrical insulation for critical valves shall be measured for resistance following installation and retested periodically. These records shall be maintained for at least 6 years.*
6. *ESD valve and SIV actuators shall also conform to the requirements of Section 3108F.3.2.*

3109F.6 Utility and auxiliary piping and pipeline systems. *Utility and auxiliary piping includes service for:*

1. *Stripping and sampling*
2. *Vapor control*
3. *Natural gas*
4. *Compressed air, venting and nitrogen*

Stripping and sampling piping shall conform to Section 3109F.2 (N/E).

Vapor return lines and VOC vapor inerting and enriching (natural gas) piping shall conform to 33 CFR 154.2100(b) [9.12] (N/E).

Compressed air, venting and nitrogen piping and fittings shall conform to ASME B31.3 [9.2] (N).

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3109F.7 Fire piping and pipeline systems. *Firewater and foam piping and fittings shall meet the following requirements:*

1. *Conform to NFPA 11 [9.13], NFPA 24 [9.14] and ASME B16.5 [9.15] (N/E).*
2. *Fire mains shall be carbon steel pipe (N/E).*
3. *High density polyethylene (HDPE) piping may be used for buried pipelines (N/E).*
4. *Piping and appurtenances shall be color-coded per local jurisdiction requirements or per ASME A13.1 [9.16] (N/E).*
5. *Pipeline stress analysis shall be performed for firewater piping and pipelines per Section 3109F.3 (N/E).*
6. *Firewater piping and pipelines supports and attachments shall be assessed per Section 3109F.4.*
7. *External visual inspection shall be performed per Section 3102F.3.5.3 (N/E).*

3109F.8 References.

[9.1] American Petroleum Institute (API), 2005, API Standard 2610 (R2010), "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2nd ed., Washington, D.C.

[9.2] American Society of Mechanical Engineers (ASME), 2015, ASME B31.3-2014 (ASME B31.3), "Process Piping," New York.

[9.3] American Society of Mechanical Engineers (ASME), 2012, ASME B31.4-2012 (ASME B31.4), "Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids," New York.

[9.4] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5.5 – Marine Terminal Oil Pipelines (2 CCR 2560 et seq.)

[9.5] American Society of Mechanical Engineers (ASME), 2008, ASME B31E, "Standard for the Seismic Design and Retrofit of Above-Ground Piping Systems," New York.

[9.6] American Society of Civil Engineers, 2011, "Guidelines for Seismic Evaluation and Design of Petrochemical Facilities," 2nd ed., New York.

[9.7] CalARP Program Seismic Guidance Committee, December 2013, "Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments," Sacramento, CA.

[9.8] American Petroleum Institute (API), 2009, API Standard 609, "Butterfly Valves: Double Flanged, Lug- and Wafer-Type," 7th ed., Washington, D.C.

[9.9] American Society of Mechanical Engineers (ASME), 2013, ASME B16.34-2013 (ASME B16.34), "Valves Flanged Threaded and Welding End," New York.

[9.10] American Petroleum Institute (API), 2010, API Standard 607, "Fire Test for Quarter-Turn Valves and Valves Equipped with Nonmetallic Seats," 6th ed., Washington, D.C.

[9.11] American Petroleum Institute (API), API Recommended Practice 520 P1 and P2 (API 520), "Sizing, Selection, and Installation of Pressure-relieving Devices, Part 1 —Sizing and Selection," 2014, 9th ed., and "Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries – Part 2 – Installation," 2015, 6th ed., Washington, D.C.

[9.12] Code of Federal Regulations (CFR), Title 33, Section 154.2100 – Vapor Control System, General (33 CFR 154.2100)

[9.13] National Fire Protection Association (NFPA), NFPA 11, "Standard for Low-, Medium-, and High-Expansion Foam," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.

[9.14] National Fire Protection Association (NFPA), NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.

[9.15] American Society of Mechanical Engineers (ASME), 2013, ASME B16.5-2013 (ASME B16.5), "Pipe Flanges and Flanged Fittings," New York.

[9.16] American Society of Mechanical Engineers (ASME), 2007, ASME A13.1-2007 (R2013) (ASME A13.1), "Scheme for the Identification of Piping Systems," New York.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 10

SECTION 3110F—MECHANICAL AND ELECTRICAL EQUIPMENT

3110F.1 General. *This section provides the minimum standards for mechanical and electrical equipment at MOTs.*

See Section 3101F.3 for definitions of "new" (N) and "existing" (E).

3110F.2 Marine loading arms.

3110F.2.1 General criteria. *Marine loading arms and ancillary systems shall conform to ASME B31.3 [10.1], 33 CFR 154.510 [10.2] and OCIMF "Design and Construction Specification for Marine Loading Arms" [10.3]. Each loading arm used for transferring oil shall have a means of being drained or closed before being disconnected.*

The following shall be considered when determining the loading arm maximum allowable extension limits:

1. *Vessel sizes and manifold locations*
2. *Lowest-low water level (datum)*
3. *Highest-high water level*
4. *Maximum vessel surge and sway*
5. *Maximum width of fendering system*

For each loading arm, the maximum allowable movement envelope limits shall comply with 2 CCR 2380 [10.4].

Loading arms and ancillary systems shall have a seismic assessment in accordance with Section 3104F.5. For seismic evaluation, design and strengthening of loading arms and ancillary equipment, seismic loads shall be computed per Section 3104F.5.4.1 and the procedure in Section 8.5.3 of ASCE/COPRI 61 [10.5]. For strength evaluation of supports and attachments, see Section 3107F.7.

3110F.2.2 Electrical and hydraulic power systems.

3110F.2.2.1 Pressure and control systems (N).

1. *Pressure gauges shall be mounted in accordance with ASME B40.100 [10.6].*
2. *The hydraulic drive cylinders shall be mounted and meet either the mounting requirements of NFPA T3.6.7 R3 [10.7] or equivalent.*
3. *In high velocity current (>1.5 knots) areas, all new marine loading arms shall be fitted with quick disconnect couplers and emergency quick release systems in conformance with Sections 6.0 and 7.0 of [10.3]. In complying with this requirement, attention shall be paid to the commentary and guidelines in Part III of reference [10.3].*
4. *Out-of-limit, balance and the approach of out-of-limit alarms shall be located at or near the loading arm console.*

3110F.2.2.2 Electrical components (N). *The following criteria shall be implemented:*

1. *Equipment shall be provided with a safety disconnecting device to isolate the entire electrical system from the electrical mains in accordance with Article 430 of the California Electrical Code [10.8].*
2. *Motor controllers and 3-pole motor overload protection shall be installed and sized in accordance with Article 430 of the California Electrical Code [10.8].*
3. *Control circuits shall be limited to 120 volts and shall comply with Articles 500 and 501 of the California Electrical Code [10.8]. Alternatively, intrinsically safe wiring and controls may be provided in accordance with Article 504 of the California Electrical Code [10.8] and UL Std. No. 913 [10.9].*
4. *Grounding and bonding shall comply with the requirements of Article 430 of the California Electrical Code [10.8] and Section 3111F.*

Section 3111F includes requirements for electrical equipment, wiring, cables, controls and electrical auxiliaries located in hazardous areas.

3110F.2.2.3 Remote operation. *The remote control system, where provided, shall conform to the recommendations of the OCIMF [10.3]. The remote operation shall be facilitated by either a pendant control system or by a hand-held radio controller (N).*

The pendant control system shall be equipped with a plug-in capability to an active connector located either in the vicinity of the loading arms, or at the loading arm outboard end on the triple swivel, and hard-wired into the control console. The umbilical cord running from the triple swivel to the control console shall be attached to the loading arm. Other umbilical cords shall have sufficient length to reach the maximum operational limits (N).

The radio controller if installed shall comply with 2 CCR 2370 [10.4] and 47 CFR Part 15 [10.10] requirements for transmitters operating in an industrial environment (N/E).

3110F.3 Oil transfer hoses (N/E). *Hoses for oil transfer service shall be in compliance with 2 CCR 2380 [10.4] and 33 CFR 154.500 [10.11].*

Hoses with nominal diameters of 6 inches or larger shall have flanges that meet ASME B16.5 [10.12], or hoses with nominal diameters of 6 inches or less may have quick disconnect fittings provided that they meet ASTM F1122 [10.13].

The minimum hose length shall safely accommodate the vessel's size and maximum movements during transfer operations and mooring (see Section 3105F.2).

3110F.4 Lifting equipment: winches and cranes. *Lifting equipment for oil service activities, other activities (if operation or failure could cause an oil release) or spill response, shall conform to the provisions in Sections 3110F.4.1 and 3110F.4.2.*

Lifting equipment inspection and maintenance shall conform to ASME B30.4 [10.14], ASME B30.7 [10.15] and ASME HST-4 [10.16], as applicable. Inspections by qualified personnel shall be performed annually. Inspection and maintenance records shall be retained.

3110F.4.1 Winches.

1. *Winches and ancillary equipment shall be suitable for a marine environment (N/E).*
2. *Winches shall be provided with a fail-safe braking system, capable of holding the load under all conditions, including a power failure (N/E).*
3. *Winches shall be fully reversible (N).*
4. *Shock, transient and abnormal loads shall be considered when selecting winch systems (N).*
5. *Winches shall have limit switches and automatic trip devices to prevent over-travel of the drum in either direction. Limit switches shall be tested and demonstrated to function correctly under operating conditions without inducing undue tensions or slack in the winch cables (N/E).*
6. *Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums (N/E).*
7. *Moving winch parts which present caught-in hazards to personnel shall be guarded (N/E).*
8. *Winches shall have clearly identifiable and readily accessible stop controls (N/E).*

3110F.4.2 Cranes (N/E).

1. *Cranes shall not be loaded in excess of the manufacturer's rating except during performance tests.*
2. *Drums on load-hoisting equipment shall be equipped with positive holding devices.*
3. *Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums.*
4. *Braking equipment shall be capable of stopping, lowering and holding a load of at least the full test load.*
5. *When not in use, crane booms shall be lowered to ground level or secured to a rest support against displacement by wind loads or other outside forces.*
6. *Safety systems including devices that affect the safe lifting and handling, such as interlocks, limit switches, load/moment and overload indicators with shutdown capability [10.17], emergency stop switches, radius and locking indicators, shall be provided.*

3110F.5 Shore-to-vessel access for personnel. *This section applies to shore-to-vessel means of access for personnel and equipment provided by the terminal. This includes ancillary structures and equipment, which support, supplement, deploy and maneuver such vessel access systems.*

Shore-to-vessel access for personnel shall conform to 29 CFR 1918.22 [10.18], Sections 19.B and 21.E of USACE EM 385-1-1 [10.19], Chapter 16.4 of ISGOTT [10.20] and the following:

1. *Shore-to-vessel access systems shall be designed to withstand the forces from dead, live, wind, vibration, impact loads and the appropriate combination of these loads. The design shall consider all the critical positions of the system in the stored, maintenance, maneuvering and deployed positions, where applicable (N).*
2. *The minimum live load shall be 50 psf on walkways and 25 plf with a 200 pounds minimum concentrated load in any location or direction on handrails (N).*
3. *The walkway shall be not less than 36 inches in width (N) and not less than 20 inches for existing walkways (E).*
4. *The shore-to-vessel access system shall be positioned so as to not interfere with the safe passage or evacuation of personnel (N/E).*
5. *Guardrails shall be provided on both sides of the access systems with a clearance between the inner most surfaces of the guardrails of not less than 36 inches and shall be maintained for the full length of the walkway (N).*
6. *Guardrails shall be at a height not less than 33 inches above the walkway surface and shall include an intermediate rail located midway between the walkway surface and the top rail (N/E).*
7. *The walkway surface, including self-leveling treads, if so equipped, shall be finished with a safe nonslip footing accommodating all operating gangway inclinations (N/E).*
8. *The undersides of aluminum gangways shall be protected with hard plastic or wooden strips to prevent being dragged or rubbed across any steel deck or component (N/E).*

3110F.6 Oil sumps and ancillary equipment. *Oil sumps and ancillary equipment shall conform to the following:*

1. *Sumps for oil drainage shall be equipped with pressure/vacuum vents, automatic draining pumps and shall be tightly covered (N/E).*
2. *Sumps which provide drainage for more than one berth should be equipped with liquid seals so that a fire on one berth does not spread via the sump (N/E).*
3. *Sumps shall be located at least 25 ft from the manifolds, base of the loading arms or hose towers (N).*
4. *Conduct periodic integrity testing of the sump containers and periodic integrity and leak testing of the related valves and piping.*

3110F.7 Vapor control systems. *Vapor control systems shall conform to 33 CFR 154.2000 through 154.2181 [10.21] and API Standard 2610 [10.22]. The effects of seismic, wind, dead, live and other loads shall be considered in the analysis and design of individual tie-downs of components, such as of steel skirt, vessels, controls and detonation arresters.*

3110F.8 Spill prevention equipment and systems maintenance (N/E). *Mechanical and electrical equipment critical to oil spill prevention and safety, such as, but not limited to: mooring line quick release and loading arm quick disconnect systems, shall be maintained and tested as per the manufacturer's recommendations (N/E). The latest records shall be readily accessible to the Division (N/E).*

3110F.9 Pumps (N/E). *Specification information for all MOT pumps providing oil and fire water service to wharf pipeline systems shall be retained. Information shall include, but not be limited to, pump make and model, motor make and model, flow rate, pressure rating and pump performance curves.*

Hydrocarbon pumps that serve the oil transfer operations at the berthing system must be maintained per API Standard 2610 [10.22]. Firewater pumps providing the wharf fire protection shall be maintained in accordance with Section 3108F.6.3.

3110F.10 Mechanical and electrical equipment seismic assessment (N/E)*. Mechanical and electrical equipment shall have a seismic assessment per Section 3104F.5. For strength evaluation of supports and attachments, see Section 3107F.7.*

3110F.11 References.

[10.1] American Society of Mechanical Engineers (ASME), 2015, ASME B31.3-2014 (ASME B31.3), "Process Piping," New York.

[10.2] Code of Federal Regulations (CFR), Title 33, Section 154.510 – Loading Arms (33 CFR 154.510)

[10.3] Oil Companies International Marine Forum (OCIMF), 1999, "Design and Construction Specification for Marine Loading Arms," 3rd ed., Witherby, London.

[10.4] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)

[10.5] American Society of Civil Engineers (ASCE), 2014, ASCE/COPRI 61-14 (ASCE/COPRI 61), "Seismic Design of Piers and Wharves", Reston, VA.

[10.6] American Society of Mechanical Engineers (ASME), 2013, ASME B40.100-2013 (ASME B40.100), "Pressure Gauges and Gauge Attachments," New York.

[10.7] National Fluid Power Association (NFPA), 2009, NFPA T3.6.7 R3-2009 (R2017) (NFPA T3.6.7 R3), "Fluid Power Systems and Products —Square Head Industrial Cylinders - Mounting Dimensions," Milwaukee, WI.

[10.8] California Code of Regulations (CCR), Title 24, Part 3, California Electrical Code.

[10.9] Underwriters Laboratory, Inc., 2013, UL Standard No. 913, "Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations," 8th ed., Northbrook, IL.

[10.10] Code of Federal Regulations (CFR), Title 47, Part 15 – Radio Frequency Devices (47 CFR 15)

[10.11] Code of Federal Regulations (CFR), Title 33, Section 154.500 – Hose Assemblies (33 CFR 154.500)

[10.12] American Society of Mechanical Engineers (ASME), 2013, ASME B16.5-2013 (ASME B16.5), "Pipe Flanges and Flanged Fittings," 13th ed., New York.

[10.13] American Society for Testing and Materials (ASTM), 2010, ASTM F1122-04(2010) (ASTM F1122), "Standard Specification for Quick Disconnect Couplings (6 in. NPS and Smaller)," 4th ed., West Conshohocken, PA.

[10.14] American Society of Mechanical Engineers (ASME), 2010, ASME B30.4-2010 (ASME B30.4), "Portal Tower and Pedestal Cranes," 10th ed., New York.

[10.15] American Society of Mechanical Engineers (ASME), 2011, ASME B30.7-2011 (ASME B30.7), "Winches," 11th ed., New York.

[10.16] American Society of Mechanical Engineers (ASME) 1999, ASME HST-1999 (R2010) (ASME HST-4), "Performance Standard for Overhead Electric Wire Rope Hoists," New York.

[10.17] Code of Federal Regulations (CFR), Title 29, Section 1917.46 – Load Indicating Devices (29 CFR 1917.46)

[10.18] Code of Federal Regulations (CFR), Title 29, Section 1918.22 – Gangways (29 CFR 1918.22)

[10.19] US Army Corps of Engineers (USACE), 2008 (05 Jul 11), EM 385-1-1, "Safety and Health Requirements Manual, Sections 19.B and 21.E, Washington, D.C.

[10.20] International Chamber of Shipping (ICS), Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors (IAPH), 2010, "International Safety Guide for Oil Tankers and Terminals (ISGOTT)," 5th ed., Witherby, London.

[10.21] Code of Federal Regulations (CFR), Title 33, Sections 154.2000 through 154.2250 – Vapor Control Systems (33 CFR 154.2000 et. seq.)

[10.22] American Petroleum Institute (API), 2005, API Standard 2610 (R2010), "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2nd ed., Washington, D.C.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 11

SECTION 3111F—ELECTRICAL SYSTEMS

3111F.1 General. *This section provides minimum standards for electrical systems at marine oil terminals.*

Electrical systems include the incoming electrical service and components, the electrical distribution system, branch circuit cables and the connections, including, but not limited to:

1. *Lighting, for operations, security and navigation*
2. *Controls for mechanical and electrical equipment*
3. *Supervision and instrumentation systems for mechanical and electrical equipment*
4. *Grounding and bonding*
5. *Corrosion protection through cathodic protection*
6. *Communications and data handling systems*
7. *Fire detection systems*
8. *Fire alarm systems*
9. *Emergency shutdown systems (ESD)*

All electrical systems shall conform to API RP 540 [11.1] and the California Electrical Code [11.2].

See Section 3101F.3 for definitions of "new" (N) and "existing" (E).

3111F.2 Hazardous area designations and plans (N/E). *Area classifications shall be determined in accordance with API RP 500 [11.3], API RP 540 [11.1] and Articles 500, 501, 504, 505 and 515 of the California Electrical Code [11.2]. A marine oil terminal shall have a current set of scaled plan drawings, with clearly designated areas showing the hazard class, division and group. The plan view shall be supplemented with sections, elevations and details to clearly delineate the area classification at all elevations starting from low water level. The drawings shall be certified by a professional electrical engineer. The plans shall be reviewed and revised when modifications to the structure, product or equipment change hazardous area identifications or boundaries.*

3111F.3 Identification and tagging. *All electrical equipment, cables and conductors shall be clearly identified by means of tags, plates, color coding or other effective means to facilitate troubleshooting and improve safety, and shall conform to the identification carried out for the adjacent on-shore facilities (N). Topics for such identification are found in Articles 110, 200, 210, 230, 384, 480 and 504 of the California Electrical Code [11.2]. Existing electrical equipment (E) shall be tagged.*

Where identification is necessary for the proper and safe operation of the equipment, the marking shall be clearly visible and illuminated (N/E). A coded identification system shall apply to all circuits, carrying low or high voltage power, control, supervisory or communication (N).

3111F.4 Purged or pressurized enclosures for equipment in hazardous locations (N/E). *Purged or pressurized enclosures shall be capable of preventing the entry of combustible gases into such spaces, in accordance with NFPA 496 [11.4]. Special emphasis shall be placed on reliability and ease of operation. The pressurizing equipment shall be electrically monitored and alarms shall be provided to indicate failure of the pressurizing or purging systems.*

Pressurized control rooms shall conform to Chapter 7 of NFPA 496 [11.4].

3111F.5 Electrical service. *Where critical circuits are used for spill prevention, fire control or life safety, an alternative service derived from a separate source and conduit system, shall be located at a safe distance from the main power service. A separate feeder from a double-ended substation or other source backed up by emergency generators will meet this requirement. A stored energy emergency power system (SEEPS) shall be provided for control and supervisory circuits associated with ESD systems (N), see Section 3111F.5.1.*

1. *Electrical, instrument and control systems used to activate equipment needed to control a fire or mitigate its consequences shall be protected from fire and remain operable for 15 minutes in a 2000°F fire, unless designed to fail-safe during fire exposure. The temperature around these critical components shall not exceed 200°F during 15 minutes of fire exposure (N).*
2. *Wiring in fireproofed conduits shall be derated 15 percent to account for heat buildup during normal operation. Type MI (mineral insulated, metal sheathed per the California Electrical Code [11.2]) cables may be used in lieu of fireproofing of wiring (N).*
3. *Emergency cables and conductors shall be located where they are protected from damage caused by traffic, corrosion or other sources (N).*
4. *Allowance shall be made for electrical faults, overvoltages and other abnormalities (N).*

Where solid state motor controls are used for starting and speed control, corrective measures shall be incorporated for mitigating the possible generation of harmonic currents that may affect the ESD or other critical systems (N).

3111F.5.1 Emergency power systems. *Emergency power systems shall be installed (N) and maintained (N/E) per NFPA 110 [11.5]. This does not include stored energy systems. Stored energy emergency power systems (SEEPS) shall be installed (N) when necessary to maintain continuous uninterruptable power to critical systems. SEEPS shall be installed (N) and maintained (N/E) per NFPA 111 [11.6].*

3111F.6 Grounding and bonding (N/E).

1. *All electrical equipment shall be effectively grounded as per Article 250 of the California Electrical Code [11.2]. All noncurrent carrying metallic equipment, structures, piping and other elements shall also be effectively grounded.*

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2. *Grounding shall be considered in any active corrosion protection system for on-shore piping, submerged support structures or other systems. Insulation barriers, including flanges or nonconducting hoses shall be used to isolate cathodic protection systems from other electrical/static sources. None of these systems shall be compromised by grounding or bonding arrangements that may interconnect the corrosion protection systems or interfere with them in any way that would reduce their effectiveness.*
3. *Bonding of vessels to the MOT structure is not permitted.*
4. *Whenever flanges of pipelines with cathodic protection are to be opened for repair or other work, the flanges shall be bonded prior to separation.*
5. *Direct wiring to ground shall be provided from all towers, loading arms or other high structures that are susceptible to lightning surges or strikes.*

3111F.7 Equipment specifications (N). *All electrical systems and components shall conform to National Electrical Manufacturers Association (NEMA) standards or be certified by a Nationally Recognized Testing Laboratory (NRTL).*

3111F.8 Illumination (N/E).

3111F.8.1 Illumination Locations. *At a minimum, MOTs shall provide fixed lighting (or luminaires) that illuminates the following areas:*

1. *Transfer connection points on the MOT*
2. *Transfer connection points on any barge moored at the MOT that may transfer oil*
3. *Transfer operations work areas on the MOT*
4. *Transfer operations work areas on any barge moored at the MOT that may transfer oil*
5. *Areas defined in Sections 17.4 and 24.6.4 of ISGOTT [11.7], as appropriate*

Lighting shall be located or shielded so as not to mislead or otherwise interfere with off-site areas as governed by federal, state and local agency requirements.

3111F.8.2 Illumination Levels. *The minimum illumination levels shall be as follows:*

1. *5.0 footcandles (54 lux) at transfer connection points*
2. *1.0 footcandle (11 lux) in transfer operations work and other areas*

Where the illumination appears to the Division to be inadequate, the Division may require verification by instrument of the levels of illumination. The illumination levels shall be verified by measurement at the locations defined in Section 3111F.8.1, if required. All measurements shall be taken on a horizontal plane, 3 feet above the MOT and barge deck or walking surface (33 CFR 154.570 (b) [11.8]).

3111F.8.3 Emergency Power for Illumination (N). *In the event of power supply failure, the emergency power system (Section 3111F.5.1) shall automatically illuminate all of the areas defined in Section 3111F.8.1, and fire pump, hydrant, monitor, foam and hose connection points on the MOT. The emergency power system shall provide power for a duration of not less than 60 minutes at a level of not less than an average of 0.5 footcandle (5.5 lux).*

3111F.9 Communications, control and monitoring systems.

3111F.9.1 Communication systems (N/E). *Communications systems shall comply with 2 CCR 2370 [11.7] and Section 6 of OCIMF "Guide on Marine Terminal Fire Protection and Emergency Evacuation" [11.9].*

3111F.9.2 Overfill monitoring and controls (N/E). *Overfill protection systems shall conform to Appendix C of API Standard 2350 [11.10]. These systems shall be tested before each transfer operation or monthly, whichever is less frequent. Where vessel or barge overfill sensors and alarms are provided, they shall comply with 33 CFR 154.2102 [11.11].*

All sumps shall be provided with level sensing devices to initiate an alarm to alert the operator at the approach of a high level condition. A second alarm shall be initiated at a high-high level to alert the operator. Unless gravity drainage is provided, sumps must have an automatic pump, programmed to start at a predetermined safe level.

3111F.9.3 Monitoring systems (N/E). *All monitoring systems and instrumentation such as, but not limited to: velocity monitoring systems, tension monitoring systems, anemometers and current meters, shall be installed, maintained and calibrated per the manufacturer's recommendations. Specifications shall be retained. The latest records shall be readily accessible to the Division.*

3111F.10 Cathodic Protection Systems (CPS) (N/E). *CPS operating, testing and maintenance criteria for underwater structures shall conform to UFC 3-570-01 [11.12]. Structure-to-electrolyte potential measurements shall be taken at least annually. CPS operating, testing and maintenance criteria for buried and submerged pipelines shall conform to API 570 [11.13].*

All electrical insulating and isolating devices for protection against static, stray and impressed currents shall be tested in accordance with 2 CCR 2341 and 2380 [11.7].

CPS design criteria and location of anodes, electrical leads and rectifiers shall be documented and retained. Periodic CPS measurements, test data and inspection findings shall be retained.

3111F.11 Electrical systems seismic assessment (N/E). *Electrical systems shall have a seismic assessment per Section 3104F.5. For strength evaluation of supports and attachments, see Section 3107F.7.*

3111F.12 References.

[11.1] American Petroleum Institute (API), 1999, API Recommended Practice 540 (R2004) (API RP 540), "Electrical Installations in Petroleum Processing Plants," 4th ed., Washington, D.C.

[11.2] *California Code of Regulations (CCR), Title 24, Part 3, California Electrical Code.*

[11.3] *American Petroleum Institute (API), 2012 (Errata January 2014), API Recommended Practice 500 (API RP 500), "Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2," 3rd ed., Washington, D.C.*

[11.4] *National Fire Protection Association (NFPA), 2012, NFPA 496, "Standard for Purged and Pressurized Enclosures for Electrical Equipment," 2013 ed., Quincy, MA.*

[11.5] *National Fire Protection Association (NFPA), NFPA 110, "Standard for Emergency and Standby Power Systems," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.*

[11.6] *National Fire Protection Association (NFPA), NFPA 111, "Standard on Stored Electrical Energy Emergency and Standby Power Systems," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.*

[11.7] *International Chamber of Shipping (ICS), Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors (IAPH), 2006, "International Safety Guide for Oil Tankers and Terminals (ISGOTT)," 5th ed., Witherby, London.*

[11.8] *Code of Federal Regulations (CFR), Title 33, Section 154.570 – Lighting (33 CFR 154.570)*

[11.9] *Oil Companies International Marine Forum (OCIMF), 1987, "Guide on Marine Terminal Fire Protection and Emergency Evacuation," 1st ed., Witherby, London.*

[11.10] *American Petroleum Institute (API), 2012, API Standard 2350, "Overfill Protection for Storage Tanks in Petroleum Facilities," 4th ed., Washington, D.C.*

[11.11] *Code of Federal Regulations (CFR), Title 33, Section 154.2102 – Facility Requirements for Vessel Liquid Overfill Protection (33 CFR 154.2102)*

[11.12] *Department of Defense, 28 November 2016, Unified Facilities Criteria (UFC) 3-570-01, "Cathodic Protection," Washington, D.C.*

[11.13] *American Petroleum Institute (API), 2009, API 570, "Piping Inspection Code: In-service Inspection, Repair, and Alteration of Piping Systems," 3rd ed., Washington, D.C.*

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

Division 12

SECTION 3112F—REQUIREMENTS SPECIFIC TO MARINE TERMINALS THAT TRANSFER LNG

3112F.1 Purpose and applicability. *Section 3112F provides minimum requirements specific to onshore marine terminals that transfer LNG. Sections 3101F through 3111F are also applicable, as appropriate. Offshore marine terminals that transfer LNG are subject to a case-by-case review and approval by the Division.*

3112F.2 Risk and Hazards Analyses.

1. *Prior to LNG transfer at marine terminal, a hazards identification exercise shall be carried out to isolate potential internal and external events that may cause a spill and/or impact to public health, safety and the environment.*
2. *Hazards analysis shall consider every component, part of a structure, equipment item, and system, whose failure could cause a major accident, result in unacceptable incident escalation beyond the design basis, or adversely affect the potential for the passive and active systems to control or shutdown the facility. Safety Critical Components and Safety Critical Systems shall be identified.*
3. *Consequence models shall be developed for credible scenarios to identify Lower Flammability Limit (LFL) hazard regions. Release diameters shall include, at a minimum, 3mm, 10mm and 50 mm sizes. Scenarios involving the marine loading arms shall consider a full bore release.*
4. *Consequence models shall develop radiant heat zones from jet and pool fires for the 25 kW/m^2, 12.5 kW/m^2, 5 kW/m^2 and 1.6 kW/m^2 thermal endpoints.*
5. *A Cryogenic Exposure Analysis (CEA) shall be conducted to identify equipment and structures susceptible to cryogenic spray and pool exposure due to LNG releases from different size holes.*
6. *A Facility Essential Systems Survivability Assessment (ESSA) shall be conducted to determine the survivability of the Safety Critical Components.*
7. *Impact on Safety Critical Components and Systems shall be mitigated.*

3112F.3 Specific berthing and mooring considerations. *In addition to the minimum design requirements for berthing and mooring in Sections 3103F, 3105F and 3107F of this code, the following shall be satisfied:*

1. *Wind force and moment coefficients for LNG vessels shall be used in accordance with Appendix A of OCIMF MEG 3 [12.1], as appropriate.*
2. *The limiting environmental criteria for which the LNG carrier may safely remain berthed at the terminal shall be determined using dynamic mooring analysis.*
3. *Real time monitoring and recording of environmental conditions including wind, current and waves shall be conducted to assist in mooring system management.*
4. *Vessel hull pressure shall be considered in fender analyses and design.*

3112F.4 Fire protection. *A Fire and Explosion Hazard Analysis (FEHA) for potential pool fires, jet fires and flash fires, considering LNG releases from different size holes, as specified in Section 3112F.2, shall be conducted and result in recommendations regarding:*

1. *Type, quantity and location of fire and gas detection devices to detect potential fires and/or gas releases in a specified time frame*
2. *Fire suppression coverage, including fixed and portable systems, and equipment necessary to allow the design scenarios to be mitigated and/or extinguished*
3. *Design application rates for required fire protection systems*
4. *Firefighting requirements, including an analysis of the capability of response by other facilities, USCG and federal, state and local agencies*

Critical structural supports and equipment within the fire exposed areas identified in the FEHA shall be provided with passive fire protection designed for the duration identified in the analysis.

Emergency shutdown (ESD) systems shall be provided, in accordance with API RP 14C [12.2] and Section 12.3 of NFPA 59A [12.3], to shut down the flow of LNG to/from the terminal and shut down equipment whose continued operation could add to or prolong an emergency event.

The ESD system shall be of a failsafe design or shall be otherwise installed, located or protected to minimize the possibility that it becomes inoperative in the event of an emergency or failure at the primary control system. ESD system components that may be exposed to fire effects shall be evaluated to confirm that the actuator operation will not be impaired.

3112F.5 LNG pipelines.

1. *All pipe specified for use in cryogenic service shall be furnished in accordance with Paragraph 323.2.2A and Table A-1 of ASME B31.3 [12.4]. The extreme thickness of insulation on cryogenic piping shall be taken into consideration during piping design.*
2. *All piping materials, including gaskets and thread compounds, shall be selected appropriate to the range of temperatures to which subjected. Piping that may be exposed to the low temperature of LNG or to the heat of an ignited spill, during an emergency where such exposure could result in a failure of the piping, shall comply with at least one of the following:*
    - *(a) Made of material(s) that can withstand both the normal operating temperature and extreme temperature to which the piping may be subjected during the emergency*

(b) *Protected by insulation or other means to delay failure due to extreme temperatures until corrective action can be taken by the operator.*

(c) *Capable of being isolated and having the flow stopped where piping is exposed only to the heat of an ignited spill during the emergency*

3. *LNG pipelines shall be designed for cool-down with liquid nitrogen where the use of LNG is not possible.*
4. *All LNG drains should be located within a containment area or piped to a collection system or containment area.*
5. *LNG lines shall be analyzed for a start-up case where the top of the pipe is 90 degrees F warmer than the bottom of the pipe. The upward bowing of the pipe shall be limited to 1.25 inches.*
6. *Pipe supports, including any insulation systems used to support pipe whose stability is essential, shall be resistant to or protected against fire exposure, escaping cold liquid, or both if they are subject to such exposure.*
7. *Pipe supports for cold lines shall be designed to minimize excessive heat transfer, which can result in piping failure by ice formations or embrittlement of supporting steel. If icing up of piping and components is unavoidable, the weight of the accumulated ice shall be considered during piping and support design.*
8. *Valves shall comply with ASME B31.5 [12.5].*
9. *Cryogenic valves in liquid cryogenic service shall not be installed in vertical lines. Valves in liquid cryogenic service shall be installed in horizontal lines with the stem in the vertical position or at least 45 degrees vertically from the horizontal centerline of the pipe.*
10. *All cryogenic valves (except butterfly valves, check valves and globe valves) shall have a body cavity relief to the "safe" side of the valve. All cryogenic valves with a body cavity relief shall be marked on the exterior of the body with a letter "V" and an arrow pointing to the direction of the venting side.*
11. *Thermal relief valves shall be installed to protect the equipment and piping from over pressuring as a result of ambient heat input to blocked in LNG or other light hydrocarbon liquids.*
12. *Cryogenic subsea pipeline designs shall be qualified by a certifying agency, acceptable to the Division, in a qualification program that demonstrates that the system has been designed, fabricated and can function as intended with safeguards provided as determined to be necessary.*

3112F.6 Mechanical components and systems.

1. *The CEA analysis shall be used to recommend acceptable cryogenic exposure durations for Safety Critical Components to produce CEA drawings.*
2. *ESD system components, which are exposed to cryogenic effects, shall be evaluated to confirm that the actuators will not be impaired by the potential exposures, thereby preventing the components from failing to a safe position.*
3. *Critical structural supports and equipment within the cryogenically exposed areas shall be provided with cryogenic insulation. The cryogenic insulation and passive fire protection shall be designed for sufficient incident duration.*
4. *For marine loading arms in LNG service, ice formation on non-insolated arms and hoses must be taken into account. Mechanisms for venting, apex venting, purging and cool down of the marine loading arms shall be identified on the P&IDs.*
5. *Areas beneath marine arms shall have restricted access during and after product transfer, until there is no longer danger of falling ice.*

3112F.7 References.

[12.1] Oil Companies International Marine Forum (OCIMF), 2008, "Mooring Equipment Guidelines (MEG3)," 3rd ed., London, England.

[12.2] American Petroleum Institute (API), 2001 (Reaffirmed 2007), API Recommended Practice 14C (API RP 14C), "Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms," 7th ed., Washington, D.C.

[12.3] National Fire Protection Association (NFPA), 2012, NFPA 59A, "Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)," 2013 ed., Quincy, MA.

[12.4] American Society of Mechanical Engineers (ASME), 2015, ASME B31.3-2014 (ASME B31.3), "Process Piping," New York.

[12.5] American Society of Mechanical Engineers (ASME), 2013, ASME B31.5-2013 (ASME B31.5), "Refrigeration Piping and Heat Transfer Components," New York.

Authority: *Sections 8750 through 8760, Public Resources Code.*

Reference: *Sections 8750, 8751, 8755 and 8757, Public Resources Code.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 32 – ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X		X	X	X			X	X	X				X										X
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

32

ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

User notes:

About this chapter: From time to time it is necessary or appropriate for a portion of a building to encroach onto an adjoining public right-of-way. Chapter 32 establishes parameters for such encroachments not only at grade but also above and below grade.

ICC code development note: Code change proposals to sections in this chapter will be considered by one of the code development committees meeting during the 2025 (Group B) Code Development Cycle.

SECTION 3201—GENERAL

3201.1 Scope. The provisions of this chapter shall govern the encroachment of structures into the public right-of-way.

3201.2 Measurement. The projection of any structure or portion thereof shall be the distance measured horizontally from the lot line to the outermost point of the projection.

3201.3 Other laws. The provisions of this chapter shall not be construed to permit the violation of other laws or ordinances regulating the use and occupancy of public property.

3201.4 Drainage. Drainage water collected from a roof, awning, canopy or marquee, and condensate from mechanical equipment shall not flow over a public walking surface.

SECTION 3202—ENCROACHMENTS

3202.1 Encroachments below grade. Encroachments below grade shall comply with Sections 3202.1.1 through 3202.1.3.

3202.1.1 Structural support. A part of a building erected below grade that is necessary for structural support of the building or structure shall not project beyond the lot lines, except that the footings of street walls or their supports that are located not less than 8 feet (2438 mm) below grade shall not project more than 12 inches (305 mm) beyond the street lot line.

3202.1.2 Vaults and other enclosed spaces. The construction and utilization of vaults and other enclosed spaces below grade shall be subject to the terms and conditions of the applicable governing authority.

3202.1.3 Areaways. Areaways shall be protected by grates, guards or other approved means.

3202.2 Encroachments above grade and below 8 feet in height. Encroachments into the public right-of-way above grade and below 8 feet (2438 mm) in height shall be prohibited except as provided for in Sections 3202.2.1 through 3202.2.3. Doors and windows shall not open or project into the public right-of-way.

3202.2.1 Steps. Steps shall not project more than 12 inches (305 mm) and shall be guarded by approved devices not less than 3 feet (914 mm) in height, or shall be located between columns or pilasters.

3202.2.2 Architectural features. Columns or pilasters, including bases and moldings, shall not project more than 12 inches (305 mm). Belt courses, lintels, sills, architraves, pediments and similar architectural features shall not project more than 4 inches (102 mm).

3202.2.3 Awnings. The vertical clearance from the public right-of-way to the lowest part of any awning, including valances, shall be not less than 7 feet (2134 mm).

3202.3 Encroachments 8 feet or more above grade. Encroachments 8 feet (2438 mm) or more above grade shall comply with Sections 3202.3.1 through 3202.3.4.

3202.3.1 Awnings, canopies, marquees and signs. Awnings, canopies, marquees and signs shall be constructed so as to support applicable loads as specified in Chapter 16. Awnings, canopies, marquees and signs with less than 15 feet (4572 mm) of clearance above the sidewalk shall not extend into or occupy more than two-thirds the width of the sidewalk measured from the building. Stanchions or columns that support awnings, canopies, marquees and signs shall be located not less than 2 feet (610 mm) in from the curb line.

3202.3.2 Windows, balconies, architectural features and mechanical equipment. Where the vertical clearance above grade to projecting windows, balconies, architectural features or mechanical equipment is more than 8 feet (2438 mm), 1 inch (25 mm) of encroachment is permitted for each additional 1 inch (25 mm) of clearance above 8 feet (2438 mm), but the maximum encroachment shall be 4 feet (1219 mm).

3202.3.3 Encroachments 15 feet or more above grade. Encroachments 15 feet (4572 mm) or more above grade shall not be limited.

3202.3.4 Pedestrian walkways. The installation of a pedestrian walkway over a public right-of-way shall be subject to the approval of the applicable governing authority. The vertical clearance from the public right-of-way to the lowest part of a pedestrian walkway shall be not less than 15 feet (4572 mm).

3202.4 Temporary encroachments. Where allowed by the applicable governing authority, vestibules and storm enclosures shall not be erected for a period of time exceeding 7 months in any 1 year and shall not encroach more than 3 feet (914 mm) nor more than one-fourth of the width of the sidewalk beyond the street lot line. Temporary entrance awnings shall be erected with a clearance of not less than 7 feet (2134 mm) to the lowest portion of the hood or awning where supported on removable steel or other approved noncombustible support.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 33 – SAFEGUARDS DURING CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X		X					X	X	X	X	X	X	X	X	X								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below				X	X		X																	
Chapter / Section																								
3301				X	X																			
3302				X	X																			
3303				X	X																			
3304				X	X																			
3304.1.5				X																				
3305				X	X																			
3306				X	X																			
3306.2				X	X		X																	
3307				X	X																			
3307.1, *Note*				X	X																			
3308				X	X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

33 SAFEGUARDS DURING CONSTRUCTION

User notes:

About this chapter: While the balance of the chapters in this code specify how a building is to be designed and constructed in order to be in compliance with the code, Chapter 33 looks to the actual construction process. Parameters are provided for demolition and for protecting adjacent property during demolition and construction. This chapter also addresses the need for a fire watch during nonworking hours for certain buildings once the construction has progressed significantly. Issues such as how to provide egress while the building is growing, the timing of standpipe and sprinkler installation, and protection of pedestrians are addressed.

ICC code development note: Code change proposals to sections preceded by the designation [F] will be considered by a code development committee meeting during the 2024 (Group A) Code Development Cycle. All other code change proposals will be considered by a code development committee meeting during the 2025 (Group B) Code Development Cycle.

SECTION 3301—GENERAL

3301.1 Scope. The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties. Fire safety during construction shall also comply with the applicable provisions of Chapter 33 of the *California Fire Code*.

3301.2 Storage and placement of construction equipment and materials. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

[BS] 3301.3 Roof loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

3301.4 Maintenance of exits, existing structural elements, fire protection devices and sanitary safeguards. Required exits, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during alterations, repairs or additions to any building or structure.

Exceptions:

1. Where such required elements or devices are being altered or repaired, adequate substitute provisions shall be made.
2. Maintenance of such elements and devices is not required where the existing building is not occupied.

3301.5 Removal of waste materials Waste materials shall be removed in a manner that prevents injury or damage to persons, adjacent properties and public rights-of-way.

SECTION 3302—OWNER'S RESPONSIBILITY FOR FIRE PROTECTION

3302.1 Site safety plan. The owner or owner's authorized agent shall be responsible for the development, implementation and maintenance of an approved, written site safety plan establishing a fire prevention program at the project site applicable throughout all phases of the construction, repair, alteration or demolition work. The plan shall be submitted and approved before a building permit is issued. Any changes to the plan shall address the requirements of this chapter and other applicable portions of the *California Fire Code*, the duties of staff and staff training requirements. The plan shall be submitted for approval in accordance with the *California Fire Code*.

3302.1.1 Components of site safety plans. Site safety plans shall include the following, as applicable:

1. Name and contact information of site safety director.
2. Documentation of the training of the site safety director and fire watch personnel.
3. Procedures for reporting emergencies.
4. Fire department vehicle access routes.
5. Location of fire protection equipment, including portable fire extinguishers, standpipes, fire department connections and fire hydrants.
6. Smoking and cooking policies, designated areas to be used where approved, and signage locations in accordance with the *California Fire Code.*
7. Location and safety considerations for temporary heating equipment.
8. Hot-work permit plan.
9. Plans for control of combustible waste material.
10. Locations and methods for storage and use of flammable and combustible liquids and other hazardous materials.
11. Provisions for site security and, where required, for a fire watch.
12. Changes that affect this plan.
13. Other site-specific information required by the *California Fire Code*.

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3302.2 Site safety director. The owner shall designate a person to be the site safety director. The site safety director shall be responsible for ensuring compliance with the site safety plan. The site safety director shall have the authority to enforce the provisions of this chapter and other provisions as necessary to secure the intent of this chapter. Where guard service is provided in accordance with the *California Fire Code*, the site safety director shall be responsible for the guard service.

3302.3 Daily fire safety inspection. The site safety director shall be responsible for the completion of a daily fire safety inspection at the project site. Each day, all building and outdoor areas shall be inspected to ensure compliance with the inspection list in this section. The results of each inspection shall be documented and maintained on-site until a certificate of occupancy has been issued. Documentation shall be immediately available for on-site inspection and review.

1. Any contractors entering the site to perform hot work each day have been instructed in the hot work safety requirements in the *California Fire Code*, and hot work is performed only in areas approved by the site safety director.
2. Temporary heating equipment is maintained away from combustible materials in accordance with the equipment manufacturer's instructions.
3. Combustible debris, rubbish and waste material is removed from the building in areas where work is not being performed.
4. Temporary wiring does not have exposed conductors.
5. Flammable liquids and other hazardous materials are stored in locations that have been approved by the site safety director when not involved in work that is being performed.
6. Fire apparatus access roads required by the *California Fire Code* are maintained clear of obstructions that reduce the width of the usable roadway to less than 20 feet (6096 mm).
7. Fire hydrants are clearly visible from access roads and are not obstructed.
8. The location of fire department connections to standpipe and in-service sprinkler systems are clearly identifiable from the access road and such connections are not obstructed.
9. Standpipe systems are in service and continuous to the highest work floor, as specified in Section 3311.
10. Portable fire extinguishers are available in locations required by Section 3309 and for roofing operations in accordance with the *California Fire Code*.
11. Where a fire watch is required, fire watch records complying with the *California Fire Code* are up-to-date.

3302.3.1 Violations. Failure to properly conduct, document and maintain documentation required by this section shall constitute an unlawful act in accordance with Section 114.1 and shall result in the issuance of a notice of violation to the site safety director in accordance with Section 114.2. Upon the third offense, the building official is authorized to issue a stop work order in accordance with Section 115, and work shall not resume until satisfactory assurances of future compliance have been presented to and approved by the building official.

SECTION 3303—DEMOLITION

3303.1 Construction documents. Construction documents and a schedule for demolition shall be submitted where required by the building official. Where such information is required, work shall not be done until such construction documents or schedule, or both, are approved.

3303.2 Pedestrian protection. The work of demolishing any building shall not be commenced until pedestrian protection is in place as required by this chapter.

3303.3 Means of egress. A horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

3303.4 Vacant lot. Where a structure has been demolished or removed, the vacant lot shall be filled and maintained to the existing grade or in accordance with the ordinances of the jurisdiction having authority.

3303.5 Water accumulation. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or on adjacent property.

3303.6 Utility connections. Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the applicable governing authority.

[F] 3303.7 Fire safety during demolition. Fire safety during demolition shall comply with the applicable requirements of this code and the applicable provisions of Chapter 33 of the *California Fire Code*.

SECTION 3304—SITE WORK

3304.1 Excavation and fill. Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Stumps and roots shall be removed from the soil to a depth of not less than 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building. Wood forms that have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose. Before completion, loose or casual wood shall be removed from direct contact with the ground under the building.

3304.1.1 Slope limits. Slopes for permanent fill shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Cut slopes for permanent excavations shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Deviation from the foregoing limitations for cut slopes shall be permitted only upon the presentation of a soil investigation report acceptable to the building official.

3304.1.2 Surcharge. Fill or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or surcharge. Existing footings or foundations that can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against lateral movement.

3304.1.3 Footings on adjacent slopes. For footings on adjacent slopes, see Chapter 18.

3304.1.4 Fill supporting foundations. Fill to be used to support the foundations of any building or structure shall comply with Section 1804.6. Special inspections of compacted fill shall be in accordance with Section 1705.6.

3304.1.5 [HCD 1] Storm water drainage and retention during construction. *Projects which disturb less than one acre of soil and are not part of a larger common plan of development which in total disturbs one acre or more, shall manage storm water drainage during construction in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.1.*

SECTION 3305—SANITARY

3305.1 Facilities required. Sanitary facilities shall be provided during construction, remodeling or demolition activities in accordance with the *California Plumbing Code*.

SECTION 3306—PROTECTION OF PEDESTRIANS

[BS] 3306.1 Protection required. Pedestrians shall be protected during construction, remodeling and demolition activities as required by this chapter and Table 3306.1. Signs shall be provided to direct pedestrian traffic.

TABLE 3306.1—PROTECTION OF PEDESTRIANS

HEIGHT OF CONSTRUCTION	DISTANCE FROM CONSTRUCTION TO LOT LINE	TYPE OF PROTECTION REQUIRED
8 feet or less	Less than 5 feet	Construction railings
	5 feet or more	None
More than 8 feet	Less than 5 feet	Barrier and covered walkway
	5 feet or more, but not more than one-fourth the height of construction	Barrier and covered walkway
	5 feet or more, but between one-fourth and one-half the height of construction	Barrier
	5 feet or more, but exceeding one-half the height of construction	None

For SI: 1 foot = 304.8 mm.

[BS] 3306.2 Walkways. A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the applicable governing authority authorizes the sidewalk to be fenced or closed. A walkway shall be provided for pedestrian travel that leads from a building entrance or exit of an occupied structure to a public way. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but shall be not less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface. Walkways shall be accessible in accordance with Chapter 11*A or 11B as applicable,* and shall be designed to support all imposed loads, and the design live load shall be not less than 150 pounds per square foot (psf) (7.2 kN/m^2).

[BS] 3306.3 Directional barricades. Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

[BS] 3306.4 Construction railings. Construction railings shall be not less than 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.

[BS] 3306.5 Barriers. Barriers shall be not less than 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors that are normally kept closed.

[BS] 3306.6 Barrier design. Barriers shall be designed to resist loads required in Chapter 16 unless constructed as follows:

1. Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.
2. The barrier material shall be boards not less than $^3/_4$-inch (19.1 mm) thick or wood structural panels not less than $^1/_4$-inch (6.4 mm) thick.
3. Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.
4. Wood structural use panels $^1/_4$ inch (6.4 mm) or $^5/_{16}$ inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center.
5. Wood structural use panels $^3/_8$ inch (9.5 mm) or $^1/_2$ inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) on center provided that a 2-inch by 4-inch (51 mm by 102 mm) stiffener is placed horizontally at mid-height where the stud spacing is greater than 2 feet (610 mm) on center.
6. Wood structural use panels $^5/_8$ inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).

[BS] 3306.7 Covered walkways. Covered walkways shall have a clear height of not less than 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. The design live load shall be not less than 150 psf (7.2 kN/m^2) for the entire structure.

Exception: Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories above grade plane are permitted to be designed for a live load of 75 psf (3.6kN/m^2) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.
2. Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.
3. Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge upon the posts.
4. Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.
5. The deck shall be planks not less than 2 inches (51 mm) thick or wood structural panels with an exterior exposure durability classification not less than $^{23}/_{32}$ inch (18.3 mm) thick nailed to the joists.
6. Each post shall be knee braced to joists and stringers by members not less than 2 inches by 4 inches (51 mm by 102 mm); 4 feet (1219 mm) in length.
7. A curb that is not less than 2 inches by 4 inches (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.

[BS] 3306.8 Repair, maintenance and removal. Pedestrian protection required by this chapter shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The owner or the owner's authorized agent, on completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

[BS] 3306.9 Adjacent to excavations. Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected where required by the building official. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16.

SECTION 3307—PROTECTION OF ADJACENT PROPERTY

[BS] 3307.1 Protection required. Adjacent public and private property shall be protected from damage during construction, remodeling and demolition work. Protection shall be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjacent property advising them that the excavation is to be made and that the adjacent property should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.

[BS] 3307.2 Excavation retention systems. Where a retention system is used to provide support of an excavation for protection of adjacent property or structures, the system shall conform to the requirements in Sections 3307.2.1 through 3307.2.3.

[BS] 3307.2.1 Excavation retention system design. Excavation retention systems shall be designed by a registered design professional to provide vertical and lateral support.

[BS] 3307.2.2 Excavation retention system monitoring. The retention system design shall include requirements for monitoring of the system and adjacent property or structures for horizontal and vertical movement.

[BS] 3307.2.3 Retention system removal. Elements of the system shall only be removed or decommissioned where adequate replacement support is provided by backfill or by the new structure. Removal or decommissioning shall be performed in such a manner that protects the adjacent property.

[HCD 1 & HCD 2] Note: *See Civil Code Section 832 for additional requirements related to adjoining properties and excavations.*

SECTION 3308—TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

3308.1 Storage and handling of materials. The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.

3308.1.1 Obstructions. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

3308.2 Utility fixtures. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

SECTION 3309—FIRE EXTINGUISHERS

[F] 3309.1 Where required. Structures under construction, alteration or demolition shall be provided with not fewer than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

[F] 3309.2 Fire hazards. The provisions of this code and the *California Fire Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

SECTION 3310—MEANS OF EGRESS

3310.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided. As construction progresses, such stairway shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 3310.2 Maintenance of means of egress. Means of egress and required accessible means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

Exception: Existing means of egress need not be maintained where approved temporary means of egress systems and facilities are provided.

SECTION 3311—STANDPIPES

[F] 3311.1 Where required. In buildings required to have standpipes by Section 905.3.1, not fewer than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to stairways complying with Section 3310.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 3311.2 Buildings being demolished. Where a building is being demolished and a standpipe exists within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

[F] 3311.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Chapter 9.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 as to capacity, outlets and materials.

SECTION 3312—AUTOMATIC SPRINKLER SYSTEM

[F] 3312.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in Section 111.3.

[F] 3312.2 Operation of valves. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 3313—WATER SUPPLY FOR FIRE PROTECTION

[F] 3313.1 Where required. An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 3313.2 through 3313.5.

Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

[F] 3313.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

[F] 3313.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

[F] 3313.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the

water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

[F] 3313.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

[F] 3313.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

[F] 3313.4 Vertical construction, Types I and II construction. If combustible building materials are delivered to the construction site, water supply in accordance with Section 3313.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

[F] 3313.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 3311, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

SECTION 3314—FIRE WATCH DURING CONSTRUCTION

[F] 3314.1 Fire watch during construction. A fire watch shall be provided during nonworking hours for construction that exceeds 40 feet (12 192 mm) in height above the lowest adjacent grade at any point along the building perimeter, for new multistory construction with an aggregate area exceeding 50,000 square feet (4645 m^2) per story or as required by the fire code official.

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CHAPTER
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Action taken *by the International Code Council* during the 2012 Code Development Process removed Chapter 34, Existing Structures, from the *International Building Code. Chapter 34 was subsequently removed from the California Building Code.*

The provisions of this chapter are contained in *Part 10, California Existing Building Code.* See Section 101.4.7.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X												X			X								
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X									
Adopt only those sections that are listed below							X																	X
Chapter / Section																								
AAMA 501.4-18								X	X	X	X	X		X	X									
AAMA 501.6-18								X	X	X	X	X		X	X									
AAMA TIR A8-16								X	X	X	X	X		X	X									
ACI 318-19																								X
ACI 355.2-22								X	X	X	X	X		X	X									
ACI 355.4-19 (21)								X	X	X	X	X		X	X									
ACI 440.2R-17								X	X	X	X	X		X	X									
ACI 506R-16								X	X	X	X	X		X	X									
ACI 506.2-13 (18)								X	X	X	X	X		X	X									
ACI 506.4R-19								X	X	X	X	X		X	X									
ACI 506.6T-17								X	X	X	X	X		X	X									
ACI 548.15-20								X	X	X	X	X		X	X									
ANSI S3.41			X																					
ASCE/SEI 41-13								†	†	X	†	†		†	†									
ASCE/SEI 41-17								X	X	†	†	†		†	†									
ASCE/SEI 41-23								X	X	X	X	X		X	X									
ASHRAE 171-2017								X	X	X	X	X		X	X									
ASME A17.1/CSA B44			X				X																	
ASME A18.1							X																	
ASME BPE-2009			X																					
ASME B31.3-2014																								X
ASTM A227/A227M-17				X	X																			
ASTM A229/A229M-17				X	X																			
ASTM A615/A615M-*22*								X	X	X	X	X		X	X									
ASTM A706/A706M-*22a*								X	X	X	X	X		X	X									
ASTM A1064-22								X	X	X	X	X		X	X									
ASTM C595/C595M-21								X	X	X	X	X		X	X									
ASTM C618-23e1								X	X	X	X	X		X	X									
ASTM C635/C635M-*22*								X	X	X	X	X		X	X									
ASTM C989-22								X	X	X	X	X		X	X									
ASTM C1019-20								X	X	X	X	X		X	X									
ASTM C1249-18 (2023)								X	X	X	X	X		X	X									
ASTM C1392-20								X	X	X	X	X		X	X									
ASTM C1394-20								X	X	X	X	X		X	X									
ASTM C1401-23								X	X	X	X	X		X	X									
ASTM C1586-20								X	X	X	X	X		X	X									
ASTM C1714/C1714M-23								X	X	X	X	X		X	X									
ASTM C1823/C1823M-20								X	X	X	X	X		X	X									
ASTM D1586-18e1								X	X	X	X	X		X	X									
ASTM D3966-22								X	X	X	X	X		X	X									
ASTM D5778-20								X	X	X	X	X		X	X									
ASTM E580/E580M-22								X	X	X	X	X		X	X									

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X												X			X								
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X									
Adopt only those sections that are listed below							X																	X
Chapter / Section																								
ASTM E662-17a			X					X	X															
ASTM E2632/E2632M-13			X																					
ASTM E2707-15			X																					
ASTM E2726/E2726-12a			X																					
ASTM E3121-17								X	X	X	X	X		X	X									
ASTM F606/F606M-21								X	X	X	X	X		X	X									
ASTM F1292-99							X																	
ASTM F1292-04							X																	
ASTM F1487-01							X																	
ASTM F1951-99							X																	
ASTM F2374			X																					
ANSI/AWC NDS w/*2024* Suppl.								X	X	X	X	X		X	X									X
AWS B5.1-2013-AMD1								X	X	X	X	X		X	X									
AWS D1.1/D1.1M-20								X	X	X	X	X		X	X									
AWS D1.2/D1.2M-14								X	X	X	X	X		X	X									
AWS D1.3/D1.3M-2018								X	X	X	X	X		X	X									
AWS D1.6/D1.6M-2017								X	X	X	X	X		X	X									
AWS D1.8/D1.8M-2021								X	X	X	X	X		X	X									
AWS QCI-16								X	X	X	X	X		X	X									
BHMA A156.10-2011							X																	
BHMA A156.19-2013							X																	
ANSI/DASMA 103-2017				X	X																			
FM 1950-2022								X	X	X	X	X		X	X									
FM 3011-99			X																					
FM 3260-00			X																					
ICC 300-*23*								X	X	X	X	X		X	X									
*ICC-ES AC01-24**								X	X	X	X	X		X	X									
*ICC-ES AC58-24**								X	X	X	X	X		X	X									
*ICC-ES AC70-24**								X	X	X	X	X		X	X									
ICC-ES AC77			X																					
*ICC-ES AC125-24**								X	X	X	X	X		X	X									
*ICC-ES AC156-24**								X	X	X	X	X		X	X									
*ICC-ES AC178-24**								X	X	X	X	X		X	X									
*ICC-ES AC193-24**								X	X	X	X	X		X	X									
*ICC-ES AC232-24**								X	X	X	X	X		X	X									
*ICC-ES AC308-24**								X	X	X	X	X		X	X									
ICC ES AC331			X																					
*ICC-ES AC358-24**								X	X	X	X	X		X	X									
*ICC-ES AC446-24**								X	X	X	X	X		X	X									
ISO 9001-15								X	X	X	X	X		X	X									
NFPA 11-*24*			X																					
NFPA 13-*25*			X																					

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X												X			X								
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X									
Adopt only those sections that are listed below							X																	X
Chapter / Section																								
NFPA 13D-*25*			X																					
NFPA 13R-*25*			X																					
NFPA 14-*24*			X																					
NFPA 20-25			X																					
NFPA 24-25			X																					
NFPA 25-13CA			X																					
NFPA 31-*24*			X																					
NFPA 32-21			X																					
NFPA 37-18			X																					
NFPA 40-*24*			X																					
NFPA 45-*24*			X																					
NFPA 54-18			X																					
NFPA 58-*24*			X																					
NFPA 72-*25*			X				X																	
NFPA 82-*24*			X																					
NFPA 92-*24*			X																					
NFPA 105-*25*			X																					
NFPA 110-*25*			X																					
NFPA 111-*25*			X																					
NFPA 120-*23*			X																					
NFPA 130-20			X																					
NFPA 170-*24*			X																					
NFPA 211-*24*			X																					
NFPA 286-*24*			X																					
NFPA 418-*24*			X																					
NFPA 502-20			X																					
NFPA 780-*23*			X																					
NFPA 1124-17			X																					
NFPA 2001-22			X																					
PCI MNL 120-17								X	X	X	X	X		X	X									
PTI DC35.1-14								X	X	X	X	X		X	X									
SFM 12-3			X																					
SFM 12-7-3			X																					
SFM 12-7A-1			X																					
SFM 12-7A-2			X																					
SFM 12-7A-3			X																					
SFM 12-7A-4			X																					
SFM 12-7A-4A			X																					
SFM 12-7A-5			X																					
SFM 12-8-100			X																					
SFM 12-10-1			X																					
SFM 12-10-2			X																					
SFM 12-10-3			X																					

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter	X												X			X								
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X									
Adopt only those sections that are listed below							X																	X
Chapter / Section																								
UBC 15-2			X																					
UBC 15-3			X																					
UBC 15-4			X																					
UL 13-96			X																					
UL 38-99			X																					
UL 193-04			X																					
UL 199-95			X																					
UL 228-97			X																					
UL 260-04			X																					
UL 262-04			X																					
UL 268A-09			X																					
UL 312-04			X																					
UL 346-05			X																					
UL 464-03			X																					
UL 497B-04			X																					
UL 521-99			X																					
UL 539-00			X																					
UL 632-00			X																					
UL 753-04			X																					
UL 790 *Edition 9-2022*			X																					
UL 813-96			X																					
UL 857-13								†	†	X	X	X		X	X									
UL 864-2014			X																					

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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CHAPTER

35 REFERENCED STANDARDS

User notes:

About this chapter:

The *California Building Code* contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.

[DSA-SS, DSA-SS/CC, OSHPD 1 & 4] Reference to other chapters. *In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 16A, 17A, 18A, 19A, 21A and 22A.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.

AA Aluminum Association, 1400 Crystal Drive, Suite 430, Arlington, VA 22202

ADM—2020: Aluminum Design Manual
1604.3.5, 2002.1

ASM 35—00: Aluminum Sheet Metal Work in Building Construction (Fourth Edition)
2002.1

AAMA Fenestration and Glazing Industry Alliance (formerly American Architectural Manufacturers Association), 1900 E Golf Road, Suite 1250, Schaumburg, IL 60173

711—22: Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
1404.4

714—23: Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal around Exterior Wall Openings in Buildings
1404.4

1402—09: Standard Specifications for Aluminum Siding, Soffit and Fascia
1403.5.1

2502—19: Comparative Analysis Procedure for Window and Door Products
1709.5

AAMA/WDMA/CSA 101/I.S.2/A440—22: North American Fenestration Standard/Specification for Windows, Doors, and Skylights
1709.5.1, 2405.5*, 1709A.5.1*

501.4-18: Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts
[OSHPD 1 & 4] Section 7.2.5, *Replace "elastic design displacement" with "design story drifts associated with the design earthquake".*
2410.1

501.6-18: Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System
2410.1

TIR A8-16: Structural Performance of Composite Thermal Barrier Framing Systems
2411.1

ACI American Concrete Institute, 38800 Country Club Drive, Farmington Hills, MI 48331-3439

117—10: Specification for Tolerances for Concrete Construction and Materials
1901.7.1

216.1—14: Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
Table 721.1(2), 722.1

318—19: Building Code Requirements for Structural Concrete
722.2.4.3, 1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, *1705A.3.9, Table 1705A.3,* 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1809.14, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8, 1810.3.9.2, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11, 1810.3.11.1, 1810.3.12, 1810.3.12, 1810.3.13, *1810A.3.10.4,* 1901.2, 1901.3, *1901A.3, 1901.3.4.4,* 1902.1, *1902A.1, 1903A,* 1903.1, *1904A,* 1904.1, 1904.2, *1905A,* 1905.1, 1905.2, 1905.3, 1905.4, 1905.5.1, 1905.6, 1905.6.2, 1905.7, 1905.7.1, 1905.7.2, 1907.1, 1908.1, *1909.2.6.4, 1909.3, 1909.4, 1910.3, 1910A.5.4*

355.2—22: Post-Installed Mechanical Anchors in Concrete—Qualification Requirements and Commentary
1617A.1.19, 1901.3.2

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355.4—19(21): Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
1617A.1.19, 1901.3.3

440.2R—17: Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
1911.3, 1911A.3

440.11—22: Building Code Requirements for Structural Concrete Reinforced with Glass Fiber Reinforced Polymer (GFRP) Bars – Code Requirements
1901.2.1

506R—16: Guide to Shotcrete
1908.1, 1908A.1

506.2—13 (18): Specification for Shotcrete
1705A.3.9, 1908.1, 1908A.1, 1909.4

506.4R—19: Guide for the Evaluation of Shotcrete
1908.1, 1908A.1, 1909.4

506.6T—17: Visual Shotcrete Core Quality Evaluation
1908.1, 1908A.1, 1909.4

548.15-20: Specification for Crack Repair by Epoxy Injection
1911.2, 1911A.2

550.5—18: Code Requirements for the Design of Precast Concrete Diaphragms for Earthquake Motions
Table 1705.3

ITG—7-09: Specification for Tolerances for Precast Concrete
1901.7.2

AISC American Institute of Steel, 130 East Randolph Street, Suite 2000, Chicago, IL 60601-6219

ANSI/AISC 341—22: Seismic Provisions for Structural Steel Buildings
1705.13.1.1, 1705.13.1.2, 1705.14.1.1, 1705.14.1.2, *Table 1705A.2.1,* 1810.3.5.3.1, 2202.2.1.1, 2202.2.1.2, 2202.2.2, *2202A.5, 2205.3, 2215.2*

ANSI/AISC 358—22: Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications
Table 1705A.2.1, 2202.2.1, 2202.2.1.2, *2202.3, 2202A.3, 2202A.6, 2215.3, 2205A, 2205.4, 2206A.2, 2206.2.1*

ANSI/AISC 360—22: Specification for Structural Steel Buildings
722.5.2.2.1, 1604.3.3, 1705.2.1, *1705A.2.1, Table 1705A.2.1, 1705A.2.5, 2201A.5.1,* 2202.1, 2202.2.1.1, *2204.4, 2204A.4, 2215.1.1, 2215A.1.2, 2215A.2.1*

ANSI/AISC 370—21: Specification for Structural Stainless Steel Buildings
1705.2.2, *1705.2.2, Table 1705A.2.1, 1705A.2.2,* 2203.1

AISI American Iron and Steel Institute, 25 Massachusetts Avenue, NW Suite 800, Washington, DC 20001

AISI S100—16(2020) w/S2—20: North American Specification for the Design of Cold-Formed Steel Structural Members, 2016 Edition (Reaffirmed 2020), with Supplement 2, 2020 Edition
1604.3.3, 1905.7.2, 2204, 2204.2.2, *2204A.1*

AISI S202—20: Code of Standard Practice for Cold-formed Steel Structural Framing, 2020 Edition
2206.1.3.1, 2206.1.3.1

AISI S220—20: North American Standard for Cold-Formed Steel Nonstructural Framing, 2020 Edition
2203.1, 2206.2, 2206.3, Table 2506.2, Table 2507.2

AISI S230—2019: North American Standard for Cold-formed Steel Framing—Prescriptive Method for One and Two Family Dwellings, 2019 Edition
1609.1.1, 1609.1.1.1, 2204.1, 2206.1.2

AISI S240—20: North American Standard for Cold-Formed Steel Structural Framing, 2020 Edition
Table 1404.5.2.1, Table 1404.5.2.2, *Table 1705A.2.1, 1709A.2.9,* 2206.1, 2206.1.1.1, 2206.1.3.3, 2206.3, 2212.1, *2206A.2,* Table 2506.2, Table 2507.2

AISI S310—20 w/S1—22: North American Standard for the Design of Profiled Steel Diaphragm Panels, with Supplement 1, 2022 Edition
2204.1, 2208.1

AISI S400—20: North American Standard for Seismic Design of Cold-formed Steel Structural Systems, 2020 Edition
2204.2.1, 2204.2.2, 2206.1.1.1, 2206.1.1.2*, 2215A.4.3*

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ALI Automotive Lift Institute, Inc., P.O. Box 85, Cortland, NY 13045

ALI ALCTV—2022: Standard for Automotive Lifts—Safety Requirements for Construction, Testing and Validation (ANSI)
Table 3001.3

AMCA Air Movement and Control Association International, 30 West University Drive, Arlington Heights, IL 60004

ANSI/AMCA 540—23: Test Method for Louvers Impacted by Wind Borne Debris
1609.2.1

ANSI American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036

A13.1—2020: Scheme for the Identification of Piping Systems
415.11.7.5

A108.1A—17: Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar
2103.2.3

A108.1B—17: Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-Portland Cement Mortar
2103.2.3

A108.4—19: Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive
2103.2.3.6

A108.5—21: Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar
2103.2.3.1, 2103.2.3.2

A108.6—99 (Reaffirmed 2019): Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy
2103.2.3.3

A108.8—99 (Reaffirmed 2019): Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout
2103.2.3.4

A108.9—99 (Reaffirmed 2019): Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout
2103.2.3.5

A108.10—17: Installation of Grout in Tilework
2103.2.3.7

A118.1—19: American National Standard Specifications for Dry-Set Cement Mortar
2103.2.3.1

A118.3—21: American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive
2103.2.3.3

A118.4—19: American National Standard Specifications for Modified Dry-set Cement Mortar
2103.2.3.2

A118.5—99 (Reaffirmed 2021): American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation
2103.2.3.4

A118.6—19: American National Standard Specifications for Standard Cement Grouts for Tile Installation
2103.2.3.7

A118.8—99: American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout
2103.2.3.5

A136.1—20: American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile
2103.2.3.6

A137.1—22: American National Standard Specifications for Ceramic Tile
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A137.3—22: American National Standard Specification for Gauged Porcelain Tile and Gauged Porcelain Tile Panels/Slabs
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E1.21—2020: Entertainment Technology—Temporary Structures Used for Technical Production of Outdoor Entertainment Events
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ES1.7—2021: Event Safety Requirements - Weather Preparedness
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907.5.2.1.4

Z 97.1—2015 (Reaffirmed 2020): Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test
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APA

APA - Engineered Wood Association, 7011 South 19th Street, Tacoma, WA 98466-7400

ANSI 117—2020: Standard Specification for Structural Glued Laminated Timber of Softwood Species
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ANSI/APA A190.1—2022: Product Standard for Structural Glued Laminated Timber
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ANSI/APA PRG 320—2019: Standard for Performance-rated Cross-laminated Timber
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ANSI/APA PRP 210—2019: Standard for Performance-Rated Engineered Wood Siding
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ANSI/APA PRR 410—2021: Standard for Performance-Rated Engineered Wood Rim Boards
2303.1.13

APA PDS Supplement 1—23: Design and Fabrication of Plywood Curved Panels
2306.1

APA PDS Supplement 2—23: Design and Fabrication of Plywood-lumber Beams
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APA PDS Supplement 3—23: Design and Fabrication of Plywood Stressed-skin Panels
2306.1

APA PDS Supplement 4—23: Design and Fabrication of Plywood Sandwich Panels
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APA PDS Supplement 5—23: Design and Fabrication of All-plywood Beams
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APA PDS—20: Panel Design Specification
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APA R540—19: Builder Tips: Proper Storage and Handling of Glulam Beams
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APA S475—20: Glued Laminated Beam Design Tables
2306.1

APA S560—20: Technical Note: Field Notching and Drilling of Glued Laminated Timber Beams
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APA T300—23: Glulam Connection Details
2306.1

APA X440—23: Product Guide: Glulam
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APA X450—23: Glulam in Residential Building—Construction Guide
2306.1

ASABE

American Society of Agricultural and Biological Engineers, 2950 Niles Road, St. Joseph, MI 49085

EP 484.3 DEC2017 (R2022): Diaphragm Design of Metal-clad, Wood-frame Rectangular Buildings
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EP 486.3 SEP2017 (R2021): Shallow-post and Pier Foundation Design
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EP 559.1 AUG2010 (R2019): Design Requirements and Bending Properties for Mechanically Laminated Wood Assemblies
2306.1

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ASCE/SEI American Society of Civil Engineers Structural Engineering Institute, 1801 Alexander Bell Drive, Reston, VA 20191

7—22: Minimum Design Loads and Associated Criteria for Buildings and Other Structures *with Supplement 1*
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8—22: Specification for the Design of Cold-Formed Stainless Steel Structural Members
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19—16: Structural Applications of Steel Cables for Buildings
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24—14: Flood Resistant Design and Construction
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29—05: Standard Calculation Methods for Structural Fire Protection
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32—01: Design and Construction of Frost-Protected Shallow Foundations
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37—2017: Design Loads on Structures during Construction
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41—13: [OSHPD 1 SPC-2 and SPC-4D only] Seismic Evaluation and Retrofit of Existing Buildings
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41—17: [DSA-SS, DSA-SS/CC] Seismic Evaluation and Retrofit of Existing Buildings
1603A.2

41—23: [DSA-SS, DSA-SS/CC] [OSHPD 1, 1R, 2, 4 and 5] Seismic Evaluation and Retrofit of Existing Buildings
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49—21: Wind Tunnel Testing for Buildings and Other Structures
1609.1.1

55—16: Tensile Membrane Structures
3102.2

ASHRAE ASHRAE, 180 Technology Parkway, Peachtree Corners, GA 30092

90.1—2022: Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings
1202.1

170—2021: Ventilation of Health Care Facilities
1020.6

171—2017: Method of Testing for Rating Seismic and Wind Restraints
1705.14.2, 1705A.14.2

ASME American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016

A17.1—2022/CSA B44—22: Safety Code for Elevators and Escalators
11B-407.1, 11B-407.1.1, 11B-407.4.9, 11B-408.1, 11B-409.1, 11B-411.1, 11B-810.9, 1607.12.1, 1612.2, 1613.5

A17.1—CSA B44: *the edition as referenced in: California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* Safety Code for Elevators and Escalators
907.3.3, 911.1.6, 1009.4.1, 3001.3, Table 3001.3, 3001.5, 3002.5, *3002.6.1,* 3003.2, 3007.1, 3008.1.4, 3008.7.1

A17.7—2007/CSA B44—07(R2017): Performance-based Safety Code for Elevators and Escalators
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A18.1—2023: Safety Standard for Platform Lifts and Stairway Chairlifts
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A90.1—2015: Safety Standard for Belt Manlifts
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B16.18—2023: Cast Copper Alloy Solder Joint Pressure Fittings
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B16.22—2023: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
909.13.1

B20.1—2024: Safety Standard for Conveyors and Related Equipment
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BPE—2009: Bio-processing Equipment Standard

B31.3—*2014: [SLC]* Process Piping
415.11.6

B31.3—2022: Process Piping
415.11.7

ASSP American Society of Safety Professionals, 520 N. Northwest Highway, Park Ridge, IL 60068

ANSI/ASSP Z359.1—2020: The Fall Protection Code
1015.6, 1015.7

ASTM ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428

A6/A6M—21: Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling
1810.3.2.3, 1810.3.5.3.1, 1810.3.5.3.3

A36/A36M—19: Specification for Carbon Structural Steel
1810.3.2.3

A153/A153M—2016A: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2304.10.6

A227/A227M—17: Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs
1211.1.1

A229/A229M—17: Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs
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A240/A240M—20a: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
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A252/A252M—19: Specification for Welded and Seamless Steel Pipe Piles
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A283/A283M—2018: Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
1810.3.2.3

A416/A416M—18: Standard Specification for Low-Relaxation, Seven-Wire Steel Strand, for Prestressed Concrete
1810.3.2.2

A463/A463M—15(2020)e1: Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
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A572/A572M—21e1: Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
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A588/A588M—19: Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi (345 MPa)- Minimum Yield Point with Atmospheric Corrosion Resistance
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A615/A615M—20: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
1704.5, 1810.3.10.2

A615/A615M—*22*: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
1704.5, 1810.3.10.2

A641/A641M—19: Specification for Zinc-coated (Galvanized) Carbon Steel Wire
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A653/A653M—20: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
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A690/A690M—13a(2018): Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
1810.3.2.3

A706/A706M—2016: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
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A706/A706M—*22a*: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
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A722/A722M—2018: Specification for High-Strength Steel Bars for Prestressed Concrete
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A755/A755M—18: Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
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A875/A875M—21: Standard Specification for Steel Sheet, Zinc-5%, Aluminum Alloy-Coated by the Hot-Dip Process
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A924/A924M—20: Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-Dip Process
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A1064—22: : Standard Specification for Carbon-steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
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B42—20: Specification for Seamless Copper Pipe, Standard Sizes
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B43—20: Specification for Seamless Red Brass Pipe, Standard Sizes
909.13.1

B68/B68M—19: Standard Specification for Seamless Copper Tube, Bright Annealed
909.13.1

B88—20: Specification for Seamless Copper Water Tube
909.13.1

B101—12(2019): Specification for Lead-Coated Copper Sheet and Strip for Building Construction
1403.5.3, Table 1507.2.8.2, Table 1507.4.3

B209—21: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
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B251/B251M—2017: Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube
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B280—20: Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
909.13.1

B370—12(2019): Specification for Copper Sheet and Strip for Building Construction
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B695—2021: Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
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C5—2018: Specification for Quicklime for Structural Purposes
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C31/C31M—21a: Practice for Making and Curing Concrete Test Specimens in the Field
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C33/C33M—2018: Specification for Concrete Aggregates
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C62—2017: Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
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C67/C67M—21: Test Methods of Sampling and Testing Brick and Structural Clay Tile
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C73—2017: Specification for Calcium Silicate Brick (Sand-Lime Brick)
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C91/C91M—2018: Specification for Masonry Cement
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C94/C94M—21b: Specification for Ready-Mixed Concrete
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C140/C140M—22a: Test Method Sampling and Testing Concrete Masonry Units and Related Units
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C270—19ae1: Specification for Mortar for Unit Masonry
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C315—2007(2021): Specification for Clay Flue Liners and Chimney Pots
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C330/C330M—2017A: Specification for Lightweight Aggregates for Structural Concrete
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C636/C636M—19: Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
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C1261—2013(2017)E1: Specification for Firebox Brick for Residential Fireplaces
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D7147—21: Specification for Testing and Establishing Allowable Loads of Joist Hangers
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D7158/D7158M—20: Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method)
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D7425/D7425M—13(2019): Standard Specification for Spray Polyurethane Foam Used for Roofing Applications
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D8257/D8257M—20: Standard Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing
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E90—2009(2016): Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
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E283/E283M—19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
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E336—20: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
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E662—17a: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
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E681—09(2015): Test Methods for Concentration Limits of Flammability of Chemical Vapors and Gases
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E970—2017: Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source
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E1300—2016: Practice for Determining Load Resistance of Glass in Buildings
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E1592—2005(2017): Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
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E2568—2017A: Standard Specification for PB Exterior Insulation and Finish Systems
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E2751/E2751M—2017A: Practice for Design and Performance of Supported Laminated Glass Walkways
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E2837—2013(2017): Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies
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F1487—01: Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
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Table 721.1(2), Table 721.1(3), Table 1404.5.3.1, Table 1404.5.3.2, 1507.2.5, 1507.16.5, 2303.6, Table 2304.10.2, 2304.10.6, Table 2506.2

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F1951—99: Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment:
11B-1008.2.6.1

F2006—21: Standard Safety Specification for Window Fall Prevention Devices for Non-emergency Escape (Egress) and Rescue (Ingress) Windows
1015.8

F2090—21: Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms
1015.8.1, 1015.8

F2200—2017: Standard Specification for Automated Vehicular Gate Construction
3110.2

F2374—2021: Standard Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices
3102

AWC American Wood Council, 222 Catoctin Circle SE, Suite 201, Leesburg, VA 20175

ANSI/AWC NDS—2024: National Design Specification (NDS) for Wood Construction—with 2024 NDS Supplement
202, 722.1, Table 1404.5.3.2, Table 1604.3, 1809.12, 1810.3.2.4, Table 1810.3.2.6, 1905.7.2, Table 2304.6.1, Table 2304.10.2, 2304.13, 2305.1.2, 2306.1, Table 2306.2(1), Table 2306.2(2), Table 2306.3(1), Table 2306.3(2), 2307.1

ANSI/AWC PWF—2021: Permanent Wood Foundation Design Specification
1805.2, 1807.1.4, 2304.10.6.2

ANSI/AWC SDPWS—2021: Special Design Provisions for Wind and Seismic
202, 1604.4, 2305.1, 2305.1.2, 2305.2, 2305.3, 2306.1, 2306.2, 2306.3, Table 2306.3(1), Table 2306.3(3), 2307.1

ANSI/AWC WFCM—2024: Wood Frame Construction Manual for One- and Two-Family Dwellings
1609.1.1, 1609.1.1.1, 2302.1, 2308.2.4, 2308.10.7.2, 2309.1

AWC STJR—2024: Span Tables for Joists and Rafters
2306.1.1, 2308.8.2.1, 2308.11.1, 2308.11.2

AWC WCD No. 4—2003: Wood Construction Data—Plank and Beam Framing for Residential Buildings
2306.1.2

AWCI Association of the Wall and Ceiling Industry, 513 West Broad Street, Suite 210, Falls Church, VA 22046

12-B—14: Technical Manual 12B, Third Edition; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-resistive Materials; an Annotated Guide
1705.16

AWPA American Wood Protection Association, P.O. Box 361784, Birmingham, AL 35236-1784

C1—03: All Timber Products—Preservative Treatment by Pressure Processes
1505.6

M4—21: Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-treated Wood Products
1810.3.2.4.1, 2303.1.9

U1—23: USE CATEGORY SYSTEM: User Specification for Treated Wood Except Commodity Specification H
Table 1507.9.6, 1807.1.4, 1807.3.1, 1809.12, 1810.3.2.4.1, *1812.2, 1812A.2,* 2303.1.9, 2304.12.1, 2304.12.2, 2304.12.2.6, 2304.12.2.7, 2304.12.2.8, 2306.1.3

AWS American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672

B5.1—2013-AMD1: Specification for the Qualification of Welding Inspectors
1705.2.7, 1705A.2.7

D1.1/D1.1M—20: Structural Welding Code—Steel
1705.2.7, Table 1705A.2.1, 1705A.2.7, 2003.1, 2201.4.1, 2202.4.2, 2202.4.3, 2202.4.4, 2202.4.5, 2215.6.2, 2216.2, 2201A.4.1, 2202A.4.2, 2202A.4.3, 2202A.4.4, 2202A.4.5, 2216A.2

D1.2/D1.2M—14: Structural Welding Code—Aluminum
2003.1

D1.3/D1.3M—2018: Structural Welding Code—Sheet Steel
Table 1705A.2.1, 1705.2.7, 1705A.2.7

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D1.4/D1.4M—2018-AMD1: Structural Welding Code—Steel Reinforcing Bars
1704.5, *1705.2.7,* Table 1705.3, 1705.3.1, 1704A.5*, 1705A.2.7,* Table 1705A.3, *1705A.3.1, 1903.5, 1903A.5,* 2107.3, 2107A.3

D1.6D/1.6M—2017: Structural Welding Code—Stainless Steel
Table 1705A.2.1, 1705A.2.7

D1.8/D1.8M—2021: Structural Welding Code—Seismic Supplement
Table 1705A.2.1, 1705.2.5, 1705A.2.7

QC1—2016: Specification for AWS Certification of Welding Inspectors
1705.2.7, 1705A.2.7

BHMA
Builders Hardware Manufacturers' Association 355 Lexington Avenue, 15th Floor New York, NY 10017

A156.10—2022: Power Operated Pedestrian Doors
1010.3.2, *11B-404.2.9, 11B-404.3*

A156.19—2019: Power Assist and Low Energy Power Operated Doors
1010.3.2, *11B-404.2.9, 11B-404.3, 11B-408.3.2.1, 11B-409.3.1*

A156.27—2019: Power and Manual Operated Revolving Pedestrian Doors
1010.3.1.1

A156.38—2019: Low Energy Power Operated Sliding and Folding Doors
1010.3.2

CEN
European Committee for Standardization (CEN), Rue de la Science 23, Brussels, Belgium 1000

BS EN 15250—2007: Slow Heat Release Appliances Fired by Solid Fuel—Requirements and Test Methods
2112.2, 2112.5

EN 1081—98: Resilient Floor Coverings—Determination of the Electrical Resistance
406.7.1

CPA
Composite Panel Association, 19465 Deerfield Avenue, Suite 306, Leesburg, VA 20176

ANSI A135.4—2012(R2020): Basic Hardboard
1403.3.1, 2303.1.7

ANSI A135.5—2012(R2020): Prefinished Hardboard Paneling
2303.1.7, 2304.7

ANSI A135.6—2012(R2020): Engineered Wood Siding
1403.3.2, 2303.1.7

ANSI A208.1—2016: Particleboard
2303.1.8, 2303.1.8.1

CPSC
Consumer Product Safety Commission, 4330 East/West Highway, Bethesda, MD 20814

16 CFR Part 1201 (2002): Safety Standard for Architectural Glazing Material
2406.2, Table 2406.2(1), 2406.3.1, 2407.1, 2407.1.4, 2408.2.1, 2408.3, 2409.2, 2409.4.1

16 CFR Part 1209 (2002): Interim Safety Standard for Cellulose Insulation
720.6

16 CFR Part 1404 (2002): Cellulose Insulation
720.6

16 CFR Part 1500 (2009): Hazardous Substances and Articles; Administration and Enforcement Regulations
202

16 CFR Part 1500.44 (2009): Method for Determining Extremely Flammable and Flammable Solids
202

16 CFR Part 1507 (2002): Fireworks Devices
202

16 CFR Part 1630 (2007): Standard for the Surface Flammability of Carpets and Rugs
804.4.1

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CSA Canadian Standards Association, 8501 East Pleasant Valley Road, Cleveland, OH 44131

AAMA/WDMA/CSA 101/I.S.2/A440—22: North American Fenestration Standard/Specifications for Windows, Doors, and Skylights
1709.5.1, 2405.5

ASME A17.1—2022/CSA B44-—22 *the edition as referenced in*: Safety Code for Elevators and Escalators, *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*
907.3.3, 911.1.6, 1009.4.1, 1607.12.1, 3001.2, Table 3001.3, 3001.5, 3002.5, 3003.2, 3007.1, 3008.1.4, 3008.7.1

ASME A17.7—2007/CSA B44.7—07(R2021): Performance-based Safety Code for Elevators and Escalators
Table 3001.3, 3001.5, 3002.5

CSSB Cedar Shake & Shingle Bureau, P. O. Box 1178, Sumas, WA 98295-1178

CSSB—97: Grading and Packing Rules for Western Red Cedar Shakes and Western Red Cedar Shingles of the Cedar Shake and Shingle Bureau
Table 1507.8.5, Table 1507.9.6

DASMA Door & Access Systems Manufacturers Association International, 1300 Sumner Avenue, Cleveland, OH 44115

ANSI/DASMA 103—2017: Standard for Counterbalance Systems on Residential Sectional Garage Doors
1210.4

ANSI/DASMA 107—2020: Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation
2603.4.1.9

ANSI/DASMA 108—2017: Standard Method for Testing Sectional Garage Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference
1709.5.2.1

ANSI/DASMA 115—2017: Standard Method for Testing Sectional Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure
1609.2.2

DHA Decorative Hardwoods Association, 42777 Trade West Dr, Sterling, VA 20166

ANSI/HPVA HP-1—2022: American National Standard for Hardwood and Decorative Plywood
2303.3, 2304.7

DOC U.S. Department of Commerce, National Institute of Standards and Technology 100 Bureau Drive, Gaithersburg, MD 20899

PS 1—22: Structural Plywood
2303.1.5, 2304.7, Table 2304.8(4), Table 2304.8(5), Table 2306.2(1), Table 2306.2(2)

PS 2—18: Performance Standard for Wood Structural Panels
2303.1.5, 2304.7, Table 2304.8(5), Table 2306.2(1), Table 2306.2(2)

PS 20—20: American Softwood Lumber Standard
202, 1810.3.2.4, 2303.1.1

DOL U.S. Department of Labor, Occupational Safety and Health Administration c/o Superintendent of Documents U.S. Government Printing Office, Washington, DC 20210

29 CFR Part 1910.1000 (2015): Air Contaminants
202

DOTn U.S. Department of Transportation, Office of Hazardous Material Safety 1200 New Jersey Avenue, SE East Building, 2nd Floor Washington, DC 20590

49 CFR 173.192—2011: Packaging for Certain Toxic Gases in Hazard Zone A
Table 415.6.5

49 CFR Parts 100–185—2015: Hazardous Materials Regulations
202

49 CFR Parts 173–178—2015: Specification of Transportation of Explosive and Other Dangerous Articles, UN 0335, UN 0336 Shipping Containers
202

49 CFR Parts 173.137—2009: Shippers—General Requirements for Shipments and Packaging—Class 8—Assignment of Packing Group
202

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EN European Committee for Standardization, Rue de la Science 23 B, Brussels, Belgium 1040, Belgium

EN 459-1—15: Building Lime. Definitions, Specifications and Conformity Criteria
2109.2.4.8.7

FEMA Federal Emergency Management Agency, 500 C Street S.W., Washington, DC 20472

FEMA-TB-11—23: Crawlspace Construction for Buildings Located in Special Flood Hazard Areas
1805.1.2.1

FM FM Approvals, Headquarters Office 1151 Boston-Providence Turnpike P.O. Box 9102, Norwood, MA 02062

FM 1950—2022: American National Standard for Seismic Sway Braces for Pipe, Tubing and Conduit
1705.14.2, 1705A.14.2

3260—00: Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling

3011—99: Approval Standard for Central Station Service for Fire Alarm and Protective Equipment Supervision
907.6.6.4

4430—2012: Approval Standard for Heat and Smoke Vents
910.3.1

4450—(1989): Approval Standard for Class 1 Insulated Steel Deck Roofs—with Supplements through July 1992
1510.2

4470—2016: Approval Standard for Single-ply Polymer-modified Bitumen Sheet, Built-up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
1504.7

4474—2020: American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures
1504.4.1, 1504.4.2, 1504.4.3

ANSI/FM 4880—2017: American National Standard for Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials
2603.4, 2603.9

GA Gypsum Association, 962 Wayne Avenue, Suite 620, Silver Spring, MD 20910

GA-216—2021: Application and Finishing of Gypsum Panel Products
Table 2508.1, 2509.2

GA-253—2021: Application of Gypsum Sheathing
Table 2508.1, 2508.2

GA-600—2021: Fire-resistance and Sound Control Design Manual, 23rd Edition
Table 721.1(1), Table 721.1(2), Table 721.1(3)

ICC International Code Council, Inc., 200 Massachusetts Avenue, NW, Suite 250, Washington, DC 20001

ICC 300—2017: ICC Standard on Bleachers, Folding and Telescopic Seating, and Grandstands
1030.1.1, 1030.7, 1607.18

ICC 300—23: [DSA-SS, DSA-SS/CC, OSHPD 1, 1R, 2, 4 and 5] Standards Specification on Bleachers, Folding and Telescopic Seating, and Grandstands
1030.1.1, 1030.7, 1607.18, 1605A.3, 1605A.3.1, 1607A.18

ICC 400—2022: Standard on Design and Construction of Log Structures
2302.1

ICC 600—2020: Standard for Residential Construction in High-Wind Regions
1609.1.1, 1609.1.1.1, 2308.2.4

ICC 900/SRCC 300—2020: Solar Thermal System Standard
3111.2.1

ICC 901/SRCC 100—2020: Solar Thermal Collector Standard
3111.2.1

ICC-ES AC 01—24*: Acceptance Criteria for Mechanical Anchors in Cracked and Uncracked Masonry Elements
1617A.1.19

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ICC-ES AC 58—24*: Acceptance Criteria for Adhesive Anchors in Masonry Elements
1617A.1.19

ICC-ES AC 70—24*: Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements
1617A.1.20

ICC-ES AC 77: Acceptance Criteria for Smoke Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames
3006.3

ICC-ES AC 125—24*: Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems
1911A.3, 1911.3

ICC-ES AC 156—24*: Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components
1705A.14.3

ICC-ES AC 178—24*: Acceptance Criteria for Inspection and Verification of Concrete, and Reinforced and Unreinforced Masonry Strengthening Using Fiber-Reinforced Polymer (FRP) Composite Systems
1911A.3, 1911.3

ICC-ES AC 193—24*: Acceptance Criteria for Mechanical Anchors in Concrete Elements
1617A.1.19, 1901.3.2

ICC-ES AC 232—24*: Acceptance Criteria for Anchor Channels in Concrete Elements
1617A.1.19, 1901.3.2

ICC-ES AC 308—24*: Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
1617A.1.19, 1901.3.3

ICC-ES AC 331: Acceptance Criteria for Smoke and Heat Vents
910.3.1

ICC-ES AC 358—24*: Acceptance Criteria for Helical Foundation Systems and Devices
1810A.3.1.5.1, 1810.3.1.5.1

ICC-ES AC 446—24*: Acceptance Criteria for Headed Cast-in Specialty Inserts in Concrete
1617A.1.19, 1901.3.2

ICC 1100—2019: Standard for Spray-applied Foam Plastic Insulation
2603.1.1

ICC/MBI 1200—2021: [OSHPD 1, 1R, 2, 4, and 5] Standard for Off-Site Construction: Planning, Design, Fabrication and Assembly
1710, 1710A

ICC/MBI 1205—2021: [OSHPD 1, 1R, 2, 4, and 5] Standard for Off-Site Construction: Inspection and Regulatory Compliance
1710, 1710A

ICC/NSSA 500—2023: ICC/NSSA Standard for the Design and Construction of Storm Shelters
202, 423.1, 423.2, 423.3.1, 423.3.2, 423.4, 423.5, 1031.2, 1604.5.1, 1604.10

SSTD 11—97: 1997 SBCCI Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles
1504.3.1.1, 1504.3.1.2, 1504.3.1.3

** Refers to International Building Code, 2024 as a referenced standard.*

ISO International Organization for Standardization, Chemin de Blandonnet 8 CP 401 1214 Vernier, Geneva, Switzerland

ISO 668—2013: Series 1 Freight Containers—Classifications, Dimensions and Ratings
Table 3114.8.5.3

ISO 1496-1—2013: Series 1 Freight Containers—Specification and Testing - Part 1: General Cargo Containers for General Purposes
3114.8, Table 3114.8.5.3

ISO 6346—1995: Freight Containers—Coding, Identification and Marking with Amendment 3—2012
3114.3

ISO 8115—86: Cotton Bales—Dimensions and Density
Table 307.1(1), Table 415.11.1.1

ISO 8336—09: Fiber-cement Flat Sheets—Product Specification and Test Methods
1403.9, 1404.17.1, 1404.17.2, Table 2509.2

ISO 9001—15: Quality Management Systems - Requirements
1705A.14.3

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MHI Material Handling Institute, 8720 Red Oak Blvd. Suite 201, Charlotte, NC 28217

ANSI MH16.1—2021: Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks
Table 1705.13.7, 2209.1

ANSI MH28.2—2022: Design, Testing and Utilization of Industrial Boltless Steel Shelving
2211.1

ANSI MH28.3—2022: Design, Testing and Utilization of Industrial Steel Work Platforms
2212.1

ANSI MH29.1—2020: Safety Requirements—Industrial Scissor Lift
Table 3001.3

ANSI MH32.1—2018: Stairs, Ladders, and Open-Edge Guards for Use with Material Handling Structures
2213.1

NAAMM National Association of Architectural Metal Manufacturers, 800 Roosevelt Road, Bldg. C, Suite 312, Glen Ellyn, IL 60137

FP 1001—18: Guide Specifications for Design of Metal Flag Poles
1609.1.1

NCMA National Concrete Masonry Association, 13750 Sunrise Valley, Herndon, VA 20171

TEK 5—8B(2005): Detailing Concrete Masonry Fire Walls
Table 721.1(2)

NFPA National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471

04—24: Standard for Integrated Fire Protection and Life Safety System Testing
901.6.2.1, 901.6.2.2

10—22: Standard for Portable Fire Extinguishers
906.2, Table 906.3(1), Table 906.3(2), 906.3.2, 906.3.4

11—*24*: Standard for Low-, Medium-, and High-Expansion Foam
904.7, 904.14, *3109F*

12—22: Standard on Carbon Dioxide Extinguishing Systems
904.8, 904.14

12A—22: Standard on Halon 1301 Fire Extinguishing Systems
904.9

13—*25*: Standard for the Installation of Sprinkler Systems *as amended
403.3.3, 712.1.3.1, 903.3.1.1, 903.3.2, 903.3.8.2, 903.3.8.5, 904.14, 905.3.4, 907.6.4, 1019.3

**NFPA 13, Amended Sections as follows:*

Revise Section 2.2 and add publications as follows:
2.2 NFPA Publications.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.*

Revise Section 6.4.3.1.1* as follows:

6.4.3.1.1* *Pipe joints shall not be located under foundation footings. The pipe under the building or building foundation shall not contain mechanical joints.*

Exceptions:

2. Where allowed in accordance with Section 6.4.3.1.
3. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

Revise Section 9.2.1.16 as follows:

9.2.1.16 *Exterior columns under 10 ft^2 (0.93m^2) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.*

Revise Section 9.2.3.1* as follows:

9.2.3.1* *Sprinklers shall be permitted to be omitted where the exterior canopies, roofs, portecocheres, balconies, decks or similar projections are constructed with materials that are noncombustible, limited-combustible or fire retardant treated wood as defined in NFPA 703, Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials.*

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Delete Section A.9.2.3.1 of Annex

Revise Section 9.2.3.2

9.2.3.2 *Sprinklers shall be permitted to be omitted from below the canopies, roofs, balconies, decks or similar projections are combustible construction, provided the exposed finish material on the roof, or canopy is noncombustible, limited-combustible or fire retardant treated wood as defined in NFPA 703, Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials, and the roofs or canopies contains only sprinklered concealed spaces or any of the following unsprinklered combustible concealed spaces:*

(1) Combustible concealed spaces filled entirely with noncombustible insulation.

(2) Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft^3 (4.5 m^3) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered attic [See *11.2.3.1.5.2(9)*].

(3) Concealed spaces over isolated small roofs or canopies not exceeding 55 ft^2 (5.1 m^2).

Delete language to section 9.2.3.3 and reserve section number.
9.2.3.3 Reserved.

Revise Section 9.3.19.1* as follows:

9.3.19.1* *Unless the requirements of 9.2.3.1 or 9.2.3.2 are met, sprinklers shall be installed under exterior roofs, canopies, porte-cochere, balconies, decks or similar projections exceeding 4 ft (1.2 m) in width.*

Revise Annex Section A9.3.19.2 as follows:

A9.3.19.2 *The presence of planters, newspaper machines and similar items, should not be considered storage.*

Add Section 9.3.19.3 as follows:

9.3.19.3 *Sprinklers may be omitted for following structures:*

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

Add new Sections 16.9.3.1.3.4 and 16.9.3.1.3.5 as follows:

16.9.3.1.3.4 *Where a system includes floor control valves, a hydraulic design information sign containing information for the floor shall be provided at each floor control valve. A hydraulic design information sign shall be provided for each area calculated. The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area.*

16.9.3.1.3.5 *Control valves, check valves, drain valves, antifreeze valves shall be readily accessible for inspection, testing and maintenance. Valves located more than 7 feet above the finished floor shall be provided with a means of opening and closing the valve from the floor level.*

Add new Sections 16.9.10.5, 16.9.10.5.1, 16.9.10.5.1.1, 16.9.10.5.1.2, 16.9.10.5.1.3, 16.9.10.5.1.4, 16.9.10.5.2 as follows:

16.9.10.5 Sectional Valves.

16.9.10.5.1 *Private fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.*

16.9.10.5.1.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

16.9.10.5.1.2 *Sectional control valves shall be indicating valves in accordance with Section 16.9.3.2.*

16.9.10.5.1.3 *Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser, and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.*

16.9.10.5.1.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

16.9.10.5.2 *A valve shall be provided on each bank where a main crosses a body of water or outside the building foundation(s) where the main or section of main runs under a building.*

Add new Section 17.2.2.9.1 as follows:

17.2.2.9.1 *Powder-driven studs used for attaching hangers to the building structure are prohibited in Seismic design Categories C, D, E and F.*

Revise Section 18.5.11.4 as follows:

18.5.11.4 *Where threaded pipe is used for sway bracing, it shall have a wall thickness of not less than Schedule 40.*

Replace Section 18.5.12.5 as follows:

18.5.12.5 *Lag screws or power-driven fasteners shall not be used to attach braces to the building structure.*

Replace Section 18.5.12.6.1 as follows:

18.5.12.6.1 *Fastening methods other than those identified in 9.3.5.12 shall not apply to other fastening methods, which shall be acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 18.5.9. Calculations shall be submitted to the authority having jurisdiction.*

Revise Section 18.5.12.7.4 as follows:

18.5.12.7.4 *Concrete anchors when identified in 18.5.11.11 shall be acceptable for use where designed in accordance with the requirements of the building code and certified by a registered professional engineer.*

Revise Section 18.6.1(3) as follows:

18.6.1*(3) *No. 12, 440 lb (200 Kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe. Powder-driven fasteners for attaching restraint is allowed to be used provided that the restraint component does not support the dead load.*

Revise Section 19.2.3.1.5.2(9) as follows:

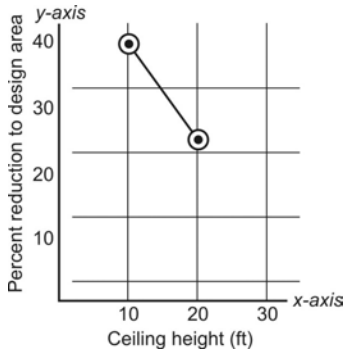
19.2.3.1.5.2(9) *Exterior columns under 10 ft^2 (0.93m^2) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system.*

Revise Section 19.2.3.2.3.1 as follows:

19.2.3.2.3.1 *Where listed quick-response sprinklers, excluding extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 19.2.3.2.3.1 when all of the following conditions are satisfied:*

(1) Wet pipe system
(2) Light hazard occupancy
(3) 20 ft (6.1 m) maximum ceiling height
(4) There are no unprotected ceiling pockets as allowed by 10.2.9 and 11.2.7 exceeding 32 ft^2 (3 m^2)

FIGURE 19.2.3.2.3.1—DESIGN AREA REDUCTION FOR QUICK-RESPONSE SPRINKLERS



Note: $y = \frac{-3x}{2} + 55$

For ceiling height $\geq$ 10 ft and $\leq$ 20 ft, $y = \frac{-3x}{2} + 55$
For ceiling height < 10 ft, y = 40
For ceiling height > 20 ft, y = 0
For SI units, 1 ft = 0.31 m.

Revise Section 19.2.3.2.3.2 as follows:

19.2.3.2.3.2 *The number of sprinklers in the design area shall never be less than seven.*

Revise Section 20.9.5.2 as follows:

20.9.5.2 *Early suppression fast-response (ESFR) sprinklers shall not be used in buildings with automatic heat or smoke vents unless the vents use a standard-response operating mechanism with a minimum temperature rating of 360°F (182°C) or 100°F (56°C) above the operating temperature of the sprinklers, whichever is higher.*

23.8.1.2 Positive Alarm Sequence

23.8.1.2.1 *Systems that have positive alarm features complying with 23.8.1.2 shall be permitted if approved by the authority having jurisdiction. Operation of a patient room smoke detector in Group I-2 and R-2.1 occupancies shall not include a positive alarm sequence feature.*

Add Section 28.1.3(18)(e) as follows:

28.1.3(18)(e) *Where a waterflow test is used for the purposes of system design, the test shall be conducted no more than 6 months prior to working plan submittal unless otherwise approved by the authority having jurisdiction.*

Revise Section 29.1 as follows:

29.1 Approval of Sprinkler Systems and Private Fire Service Mains. *The installing contractor shall do the following:*

(1) Notify the authority having jurisdiction and the property owner or property owner's authorized representative of the time and date testing will be performed.

(2) Perform all required testing (*see Section 29.2*).

(3) Complete and sign the appropriate contractor's material and test certificate(s) (*see Figure A.29.1*).

(4) Remove all caps and straps prior to placing the sprinkler system in service.

(5) Upon system acceptance by the authority having jurisdiction a label prescribed by Title 19 California Code of Regulations, Chapter 5 shall be affixed to each system riser.

Revise Section 29.3 as follows:

29.3 Instructions. *The installing contractor shall provide the property owner or the property owner's authorized representative with the following:*

(1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.

(2) NFPA 25, *Standard for the Inspection, testing, and maintenance of Water-Based Fire Protection Systems, 2013 California Edition.*

(3) Title 19, California Code of Regulations, Chapter 5, "Fire Extinguishing Systems."

Revise Section 29.4.1 as follows:

29.4.1 *The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area. Pipe schedule systems shall be provided with a sign indicating that the system was designed and installed as a pipe schedule system and the hazard classification(s) included in the design.*

Revise Section 29.4.3 as follows:

29.4.3 *The sign shall include the following information:*

(1) Location of the design area or areas

(2) Discharge densities over the design area or areas

(3) *Required flow and pressure of the system at the base of the riser.*

(4) Occupancy classification or commodity classification and maximum permitted storage height and configuration

(5) Hose stream allowance included in addition to the sprinkler demand

(6) The name of the installing contractor

(7) Required flow and pressure of the system at the water supply source.

(8) Required flow and pressure of the system at the discharge side of the fire pump where a fire pump is installed.

(9) Type or types and number of sprinklers or nozzles installed including the orifice size, temperature rating, orientation, K-Factor, sprinkler identification number (SIN) for sprinkler heads when applicable, and response type.

(10) The minimum discharge flow rate and pressure required from the hydraulically most demanding sprinkler.

(11) The required pressure settings for pressure reducing valves.

(12) For deluge sprinkler systems, the required flow and pressure at the hydraulically most demanding sprinkler or nozzle.

(13) The protection area per sprinkler based on the hydraulic calculations.

(14) The edition of NFPA 13 to which the system was designed and installed.

Revise Section 29.6.1 as follows:

29.6.1 *The installing contractor shall provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, 2013 California Edition.*

13D—*25*: Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, *as amended** 903.3.1.3

****NFPA 13D, Amended Sections as follows:***

Revise Section 6.2.2 to read as follows:

6.2.2 *Where a well, pump, tank or combination thereof is the source of supply for a fire sprinkler system, the configuration for the system shall be one of the following:*

(1) The water supply shall serve both domestic and fire sprinkler systems.

(a) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.

(b) Any disconnecting means for the pump shall be approved.

(c) A method for refilling the tank shall be piped to the tank.

(d) A method of seeing the water level in the tank shall be provided without having to open the tank.

(e) The pump shall not be permitted to sit directly on the floor.

(2) A stand-alone tank is permitted if the following conditions are met:

(a) The pump shall be connected to a 220-volt circuit breaker shared with a common household appliance (e.g., range, oven, dryer),

(b) The pump shall be a stainless steel 240-volt pump,

(c) A valve shall be provided to exercise the pump. The discharge of the exercise valve shall drain to the tank, and

(d) A sign shall be provided stating: "Valve must be opened monthly for 5 minutes."

(e) A means for automatically refilling the tank level, so that the tank capacity will meet the required water supply duration in minutes, shall be provided.

(f) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.

(g) Any disconnecting means for the pump shall be approved.

(h) A method for refilling the tank shall be piped to the tank.

(i) A method of seeing the water level in the tank shall be provided without having to open the tank.

(j) The pump shall not be permitted to sit directly on the floor.

Add new Section 6.2.2.1 as follows:

6.2.2.1 *Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.*

Add new Section 6.2.4 as follows:

6.2.4 *Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler. For multipurpose piping systems, the 5 gpm (19 L/min) demand shall be added at the domestic connection nearest the design area. This demand may be split between two domestic connections at 2.5 gpm (10 L/min) each.*

Revise Section 8.3.4 as follows:

8.3.4* *Sprinklers shall not be required in detached garages, open attached porches, carports with no habitable space above, and similar structures.*

Add *new* Sections *8.3.11 and 8.3.11.1* as follows:

8.3.11 Solar photovoltaic panel structures

8.3.11.1 *Sprinklers shall be permitted to be omitted from the following structures:*

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

13R—*25*: Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies, *as amended**

903.3.1.2, 903.3.5.2, 903.4.1

NFPA 13R, Amended Sections as follows:

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.

Add new Sections 6.6.10 and 6.10.1 as follows:

6.6.10 Solar photovoltaic panel structures

6.6.10.1 *Sprinklers shall be permitted to be omitted from the following structures:*

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

Revise Section 11.4 as follows:

11.4 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

(1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.

(2) NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 2013 California Edition and Title 19, California Code of Regulations, Chapter 5.

(3) Once the system is accepted by the authority having jurisdiction a label as prescribed by Title 19, California Code of Regulations, Chapter 5, shall be affixed to each system riser.

14—*24*: Standard for the Installation of Standpipe and Hose Systems, *as amended**

905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

NFPA 14, Amended Sections as follows:

Replace Section 6.3.7.1

6.3.7.1 *System water supply valves, isolation control valves and other valves in fire mains shall be supervised in an approved manner in the open position by one of the following methods:*

(1) Where a building has a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) a central station, proprietary or remote supervising station, or

(b) a local signaling service that initiates an audible signal at a constantly attended location.

(2) Where a building does not have a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:

(a) Locking the valves in the open position, or

(b) Sealing of valves and an approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

17—*24*: Standard for Dry Chemical Extinguishing Systems

904.6, 904.14

17A—*24*: Standard for Wet Chemical Extinguishing Systems

904.5, 904.14

20—*25*: Standard for the Installation of Stationary Pumps for Fire Protection

412.2.4.1, 913.1, 913.2, 913.2.1, 913.5

24—25: Standard for Installation of Private Fire Service Mains and Their Appurtenances, as amended*

3109F

NFPA 24, Amended Sections as follows:

Amend Section 4.2.1 as follows:

Section 4.2.1. Installation work shall be done by fully experienced and responsible *contractors. Contractors shall be appropriately licensed in the State of California to install private fire service mains and their appurtenances.*

Revise Section 4.2.2 as follows:

4.2.2 *Installation or modification of private fire service mains shall not begin until plans are approved and appropriate permits secured from* the authority having jurisdiction.

Add Section 4.2.2.1 as follows:

4.2.2.1 *As approved by the authority having jurisdiction, emergency repair of existing system may start immediately, with plans being submitted to the authority having jurisdiction within 96 hours from the start of the repair work.*

Revise Section 5.9.5.1 as follows:

5.9.5.1 Fire department connections shall be on the street side of buildings and *as approved by the authority having jurisdiction.*

Add Sections 6.6.1.1, 6.6.1.2, 6.6.1.3 and 6.6.1.4 as follows:

6.6.1.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

6.6.1.2 *Sectional control valves shall be indicating valves in accordance with NFPA 13, Section 6.7.1.3.*

6.6.1.3 *Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.*

6.6.1.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

Revise Section 10.4.3.1.1 as follows:

10.4.3.1.1 Pipe joints shall not be located under foundation footings. *The pipe under the building or building foundation shall not contain mechanical joints.*

Exceptions:

1. Where allowed in accordance with 10.4.3.2.

2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

Revise Section 10.9.1 as follows:

10.9.1 *Backfill shall be well tamped in layers or puddle under and around pipes to prevent settlement or lateral movement.* Backfill shall consist of clean fill sand or pea gravel to a minimum 6″ below and to a minimum of 12″ above the pipe *and shall contain no ashes, cinders, refuse, organic matter or other corrosive materials. Other backfill materials and methods are permitted where designed by a registered professional engineer and approved by the enforcing agency.*

25—13CA: California NFPA 25 Edition (Based on the 2011 Edition) *Inspection, Testing and Maintenance of Water-based Fire Protection Systems*

Chapter 31F, 3108F

30—24: Flammable and Combustible Liquids Code, *as amended**

415.6.1, 415.6.2, 507.8.1.1.1, 507.8.1.1.2

30A—24: Code for Motor Fuel Dispensing Facilities and Repair Garages

406.2.9.2

31—*24*: Standard for the Installation of Oil-Burning Equipment

2113.15

32—21: Standard for Drycleaning Facilities, *as amended**

415.9.3, *2101.1.1*

NFPA 32, Amended Sections as follows:

Delete the following publications from Section 2.2:

2.2 NFPA Publications.

NFPA 10, Standard for Portable Fire Extinguishers, 2010 edition.
NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2011 edition.
NFPA 70, National Electrical Code®, 2011 edition.
NFPA 101®, Life Safety Code®, 2009 edition.
NFPA 5000®, Building Construction and Safety Code®, 2009 edition.

Revise Section 4.4.1.1 as follows:

4.4.1.1 General building and structure design and construction shall be in accordance with *California Building Code.*

Delete language to Sections 4.4.1.2 and 4.4.1.3 and reserve section numbers.

4.4.1.2 Reserved

4.4.1.3 Reserved

Revise Section 4.4.4 as follows:

4.4.4 Means of Egress. Means of egress shall conform with the provisions of *the California Building Code.*

Revise Section 4.6.2 as follows:

4.6.2 Automatic Sprinkler Systems. Where required by this standard, automatic sprinkler systems shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems,* and periodically inspected, tested and maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5.*

Revise Section 4.6.4 as follows:

4.6.4 Portable Fire Extinguishers. Suitable numbers and types of portable fire extinguishers shall be installed and maintained throughout the drycleaning plant in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3.*

Revise Section 7.3.2 as follows:

7.3.2 Electrical Installations. Electrical equipment and wiring in a Type II drycleaning room shall comply with the provisions of *California Electrical Code,* for use in Class I, Division 2 hazardous locations.

37—18: Installation and Use of Stationary Combustion Engines and Gas Turbines

40—*24*: Standard for the Storage and Handling of Cellulose Nitrate Film

409.1

45—*24*: Standard on Fire Protection for Laboratories Using Chemicals

428.3.7

54—18: National Fuel Gas Code

58—*24*: Liquefied Petroleum Gas Code

415.9.2

61—20: Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities

426.1

68—13: Standard on Explosion Protection by Deflagration Venting

Table 414.5.1

70—23: National Electrical Code

108.3, 406.2.7, 406.2.9, 412.5.7, 415.11.1.8, Table 509.1, 904.3.1, 907.6.1, 909.12.2, 909.16.3, 910.4.6, 1204.4.1, 2701.1, 2702.1.3, 3111.3

72—*25*: National Fire Alarm and Signaling Code, *as amended**

407.4.4.5.1, 407.4.4.6, 901.6, 903.4.1, 904.3.5, 907.1.2, 907.2, 907.2.6, 907.2.9.3, 907.2.11, 907.2.13.2, 907.3, 907.3.3, 907.3.4, 907.5.2.1.2, 907.5.2.2, 907.5.2.2.5, 907.6, 907.6.1, 907.6.2, 907.6.6, 907.7, 907.7.1, 907.7.2, 911.1.6, 915.3.2, 915.3.3, 915.3.4, 915.4.1, 915.5.2, 915.7, 917.1, 2702.2.4, 3005.5, 3007.7, *3108F*

NFPA 72, Amended Sections as follows:

Revise Section 10.3.1 as follows:

10.3.1 Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used. *Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.*

Revise Section 10.3.3 as follows:

10.3.3 All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be *California State Fire Marshal* listed for use with the control unit.

Revise Section 12.3.8.1 as follows:

12.3.8.1 The outgoing and return (redundant) circuit conductors shall be permitted in the same cable assembly (i.e., multiconductor cable), enclosure or raceway only under the following conditions:

(1) For a distance not to exceed 10 ft (3.0 m) where the outgoing and return conductors enter or exit the initiating device, notification appliance or control unit enclosures.

(2) Single drops installed in the raceway to individual devices or appliances.

(3)*In a single room not exceeding 1000 ft^2 (93 m^2) in area, a drop installed in the raceway to multiple devices or appliances that does not include any emergency control function devices.

(4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire-resistive rating.

Revise Section 14.4.6.1 as follows:

14.4.6.1 Testing. Household fire alarm systems shall be tested in *accordance with the manufacturer's published instructions* according to the methods of Table 14.4.3.2.

Revise Section 17.16 as follows:

17.*16 Fire Extinguisher Electronic Monitoring Device.* A fire extinguisher electronic monitoring device shall indicate those conditions for a specific fire extinguisher required by *California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2 (c) and California Fire Code to a fire alarm control unit.*

Delete the amendments to Section 21.3.6 and adopt the model text.

Revise Section 12.3.8 as follows:

12.3.8 (5) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

23.8.1.2 Positive Alarm Sequence

23.8.1.2.1 *Systems that have positive alarm features complying with 23.8.1.2 shall be permitted if approved by the authority having jurisdiction. Operation of a patient room smoke detector in Group I-2 and R-2.1 occupancies shall not include a positive alarm sequence feature.*

Revise Section 23.8.5.1.2 as follows:

23.8.5.1.2* Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

***Exception*:** Fire alarm systems dedicated to elevator recall control, supervisory service and fire sprinkler monitoring *as permitted in Section 17.15 of NFPA 72.*

Revise Section 23.8.5.4.1 as follows:

23.8.5.4.1 Systems equipped with alarm verification features shall be permitted under the following conditions:

(1) The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.

(2) A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 by more than 30 seconds.

(3) Actuation of an alarm-initiating device other than a smoke detector causes the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 without additional delay.

(4) The current status of the alarm verification feature is shown on the record of completion *(see Figure 7.8.2(a), Item 4.3).*

(5) Operation of a patient room smoke detector in I-2 and R-2.1 occupancies shall not include an alarm verification feature.

Revise Section 29.3.1 as follows:

29.3.1 All devices, combinations of devices and equipment to be installed in conformity with this chapter shall be approved *and* listed *by the California State Fire Marshal* for the purposes for which they are intended.

Revise Section 29.8.2.1.1 as follows:

29.8.2.1.1* Smoke and Heat Alarms. *Where connected to a supervising station unless* exempted by applicable laws, codes or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.

Note: Exception to 29.8.2.1.1 not adopted by the SFM.

Add Section 29.10.2.1 as follows:

29.10.2.1 *The alarm verification feature shall not be used for household fire warning equipment.*

Add Section 29.10.6.8.1 as follows:

29.10.6.8.1 *The alarm verification feature shall not be used for household fire warning equipment.*

80—22: Standard for Fire Doors and Other Opening Protectives
410.2.5, 509.4.2, 716.1, 716.2.5.1, 716.2.6.4, 716.2.9, 716.3.4.1, 716.3.5, 716.4.3, 909.18.3, 1010.3.3

82—*24*: Standard on Incinerators and Waste and Linen Handling Systems and Equipment
713.13

85—23: Boiler and Combustion Systems Hazards Code
426.1

92—*24*: Standard for Smoke Control Systems
909.7, 909.8

99—24: Health Care Facilities Code
407.11, 422.6, 425.1

101—24: Life Safety Code
1030.6.2

105—*25*: Standard for Smoke Door Assemblies and Other Opening Protectives
909.20.4.1, 405.4.2, 710.5.2.2, 716.2.10, 909.18.3

110—*25*: Standard for Emergency and Standby Power Systems
2702.1.3, *3111F*

111—*25*: Standard on Stored Electrical Energy Emergency and Standby Power Systems
2702.1.3, *3111F*

120—*23*: Standard for Fire Prevention and Control in Coal Mines
426.1

130—20: **Standard for Fixed Guideway Transit and Passenger Rail Systems**
443

****NFPA 130, Amended Sections as follows:***

Amend Section 2.2 and amend publications to read as follows:

2.2 NFPA Publications.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, *2013 California edition.*

Amend Section 3.3.44.2 and amend publications to read as follows:

3.3.44.2* Open Station. A station that is constructed such that it is directly open to the atmosphere and smoke and heat are allowed to disperse directly into the atmosphere.

The following enclosed areas in open stations are permitted:

1. *Ticket/pass booths not exceeding 150 square feet (13.9 m^2) in area.*
2. *Mechanical and electrical spaces typically not used for human occupancy and necessary for the operation of a fixed guideway transit system. Such spaces shall be limited to two per level.*
3. *Restrooms not exceeding 150 square feet (13.9 m^2) in area. A maximum of four restrooms are permitted per level.*

Add a new definition as 3.3.44.3 to read as follows:

3.3.44.1.1 Underground Station. *A station or portion thereof that is located beneath the surface of the earth or of the water.*

Amend Section 5.2.2.1 to read as follows:

5.2.2.1 Building construction for all new enclosed stations shall be not less than *Type IA, Type IB or Type IIA construction and shall not exceed in area or height the limits specified in the California Building Code Table 503,* for the station configuration or as determined by fire hazard analysis of potential fire exposure hazards to the structure.

Add Section 5.2.2.1.1 –5.2.2.1.3 to read as follows:

5.2.2.1.1 *Underground stations shall be a minimum Type IA or Type IB constructions.*

5.2.2.1.2 *Open stations may be of Type IIB construction and shall not exceed in area or height as required by Table 503 for Type IIA.*

5.2.2.1.3 *Open at grade stations may be of any construction type allowed by the California Building Code.*

Delete Section 5.2.2.2.

Amend Section 5.2.4.3 to read as follows:

5.2.4.3 Ancillary Spaces. Fire resistance ratings of separations between ancillary occupancies shall be established as required by the *California Building Code.*

Amend Section 5.2.4.3.1 to read as follows:

5.2.4.3.1 *The following areas shall be separated by a two-hour fire barrier:*

1. Electrical control rooms, auxiliary electrical rooms and associated battery rooms

2. Trash rooms

3. Train control rooms and associated battery rooms

4. Fan rooms

5. Emergency generator rooms

Amend Section 5.2.4.5 to read as follows:

5.2.4.5* Separation Between System and Nonsystem Occupancies. All station public areas shall be fire separated from adjacent non-system occupancies *by a one hour fire barrier, unless otherwise required by other provisions of the California Building Code.*

Amend Section 5.3.1.1 to read as follows:

5.3.1.1 The provisions for means of egress for a station shall comply with Chapter *10 of the California Building Code,* except as herein modified.

Amend Section 5.3.2.1 to read as follows:

5.3.2.1* The occupant load for a station shall be based on the train load of trains simultaneously entering the station on all tracks in normal traffic direction plus the simultaneous entraining load awaiting trains.

(1) The train load shall consider only one train at any one track.

(2) The basis for calculating train and entraining loads shall be the peak period ridership figures as projected for design of a new system or as updated for an operating system.

(3) Exiting shall be provided for occupant loads recalculated upon increase in service and/ or every five years.

Amend Section 5.3.3.5 to read as follows:

5.3.3.5 Travel Distance. The maximum travel distance on the platform to a point at which a means of egress route leaves the platform shall not exceed *91 440 mm (300 feet).*

Amend Section 5.3.3.7 to read as follows:

5.3.3.7 Alternate Egress. At least two means of egress remote from each other shall be provided from each station platform as follows:

(1)*A means of egress used as a public circulation route shall be permitted to provide more than 50 percent of the required egress capacity from a station platform or other location.

(2) Means of egress from separate platforms shall be permitted to converge.

(3) Where means of egress routes from separate platforms converge, the subsequent capacity of the egress route shall be sufficient to maintain the required evacuation time from the incident platform.

(4) Enclosed station platforms shall have a minimum of one exit within 2.5 times the least width of the enclosed station platform up to a maximum of 50 feet (insert mm) from each end.

(5) Routes from platform ends into the underground guideway shall not be considered as exits for calculating exiting requirements.

Amend Section 5.3.11.1 to read as follows:

5.3.11.1 Illumination of the means of egress in stations, including escalators that are considered a means of egress, shall be in accordance with *Chapter 10* of the *California Building Code.*

Amend Section 5.3.11.2 to read as follows:

5.3.11.2 Means of egress, including escalators considered as means of egress, shall be provided with a system of emergency lighting in accordance with *Chapter 10* of the *California Building Code.*

Amend Section 5.4.1.1 to read as follows:

5.4.1.1 Enclosed stations shall be provided with a fire command center in accordance with *Section 911.1.1 through 911.5 of the California Building Code.*

Amend Section 5.4.4.1 to read as follows:

5.4.4.1* An automatic sprinkler protection system shall be provided *where required by Section 903 of the California Building Code.*

Delete Section 5.4.4.2.

Amend Section 5.4.5.1 to read as follows:

5.4.5.1* Class I standpipes shall be installed *where required by Chapter 9 of the California Building Code* in accordance with NFPA 14 except as modified herein.

Amend Section 7.3.2.1 to read as follows:

7.3.2.1 The fan inlet airflow hot temperature shall be determined by an engineering analysis, however, this temperature shall not be less than *482°C (250°F). Ventilation fans and related components shall be capable of withstanding the maximum anticipated plus/minus pressure transients induced by train operations.*

Add Section 7.6.1.1 to read as follows:

7.6.1.1 *Ventilation of stations shall not terminate at grade on any vehicle roadway.*

Amend Section 7.7.1 to read as follows:

7.7.1 Operation of the emergency ventilation system components shall be *capable of automatic and manual initiation in accordance with 909.12.3 of the California Building Code.*

Amend Section 7.8.1 to read as follows:

7.8.1 The design of the power for the emergency ventilation system shall comply with the requirements of Article 700 of *the California Electrical Code and Section 909 of the California Building Code.*

170—*24*: Standard for Fire Safety and Emergency Symbols
1025.2.6.1

211—*24*: Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
2112.5

221—24: Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls
706.2, Table 716.1(2)

252—22: Standard Methods of Fire Tests of Door Assemblies
Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.1.2, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1

253—23: Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
406.2.4, 424.2, 804.2, 804.3

257—22: Standard on Fire Test for Window and Glass Block Assemblies
Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4

259—23: Standard Test Method for Potential Heat of Building Materials
2603.4.1.10, 2603.5.3

265—23: Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or *Expanded Vinyl Wall Coverings* on Full Height Panels and Walls
803.5.1, 803.5.1.1

268—22: Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
1405.1.1.1, 1405.1.1.1.1, 1405.1.1.1.2, 2603.5.7

275—22: Standard Method of Fire Tests for the Evaluation of Thermal Barriers
508.4.4.1, 509.4.1.1, 1406.10.2, 1408.10.2, 2603.4

276—23: Standard Method of Fire Test for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-Deck Roofing Components
1508.1, 2603.3, 2603.4.1.5

285—23: Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components
718.2.6, 1402.6, 1406.10.3, 1408.10.4, 1511.6.2, 2603.5.5

286—*24*: Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
402.6.4.4, 424.2, 803.1.1, 803.1.1.1, 803.11, 803.12, 803.13, 1406.10.2, 1408.10.3, 2603.7, 2603.9, 2604.2.4, 2614.4, 3105.3

288—22: Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies
712.1.13.1

289—23: Standard Method of Fire Test for Individual Fuel Packages
402.6.2, 402.6.4.5, 424.2, 806.4

409—22: Standard on Aircraft Hangars
412.3.6, Table 412.3.6, 412.3.6.1, 412.5.5

418—*24*: Standard for Heliports
412.7.4

484—22: Standard for Combustible Metals
426.1

502—20: Standard for Road Tunnels, Bridges, and Other Limited Access Highways
429

652—19: Standard on the Fundamentals of Combustible Dust
426.1

654—20: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
426.1

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655—19: Standard for the Prevention of Sulfur Fires and Explosions
426.1

664—20: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
426.1

701—23: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
410.2.6, 424.2, 806.4, 3102.3, 3102.3.1, 3102.6.1.1, 3105.3

704—22: Standard System for the Identification of the Hazards of Materials for Emergency Response
202, 415.5.2

750—23: Standard on Water Mist Fire Protection Systems
202, 904.11.1.1, 904.14

770—21: Standard on Hybrid (Water and Inert Gas) Fire-Extinguishing Systems
904.13

780—*23*: Standard for the Installation of Lightning Protection Systems
2703.2, 2703.2.1, 2703.3

1124—22: Code for the Manufacture, Transportation, and Storage *and Retail Sales* of Fireworks and Pyrotechnic Articles
415.6.4.1

2001—22: Standard on Clean Agent Fire Extinguishing Systems*, as amended**
904.10

NFPA 2001, Amended Sections as follows:

Add Sections 4.3.5.1.1 and 4.3.5.2.1 to read as follows:

4.3.5.1.1 *Alarms signals from the fire extinguishing system shall not interfere with the building fire alarm signal.*

4.3.5.2.1 *The lens on visual appliances shall be "red" in color.*

Exception: Other lens colors are permitted where approved by the enforcing agency.

2010—20: Standard for Fixed Aerosol Fire-Extinguishing Systems
904.13

PCI Precast Prestressed Concrete Institute, 8770 West Bryn Mawr, Suite 1150, Chicago, IL 60631-3517

MNL-120—17: PCI Design Handbook, 8th Edition
1909A.1.1, 1909A.1.2

PCI 124—18: Specification for Fire Resistance of Precast/Prestressed Concrete
722.1, 722.2.3.1

PCI 128—19: Specification for Glass-Fiber-Reinforced Concrete Panels
1903.2

PTI Post-Tensioning Institute, 38800 Country Club Drive, Farmington Hills, MI 48331

PTI DC10.5—19: Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive and Stable Soils
1808.6.2

PTI DC35.1—14: Recommendations for Prestressed Rock and Soil Anchors
1810A.3.10.4, 1811A.2, 1812A.4, 1812A.5, 1810.3.10.4.1, 1811.2, 1812.4, 1812.5,1813.2

RMI Rack Manufacturers Institute, 8720 Red Oak Boulevard, Suite 201, Charlotte, NC 28217

ANSI MH16.1—2021: Design, Testing and Utilization of Industrial Storage Racks

ANSI MH16.3—2021: Specification for the Design, Testing and Utilization of Industrial Steel Cantilevered Storage Racks
2209.2

SBCA Structural Building Components Association, 6300 Enterprise Lane, Madison, WI 53719

ANSI/SBCA FS 100—2012(R2018): Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies
2603.10

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SDI Steel Deck Institute, 2661 Clearview Road #3, Allison Park, PA 15101

ANSI/SDI QA/QC—2022: Standard for Quality Control and Quality Assurance for Installation of Steel Deck
1705.2.3

ANSI/SDI SD—2022: Standard for Steel Deck
2208.1

SFM State of California, Department of Forestry and Fire Protection, Office of the State Fire Marshal, P.O. Box 944246, Sacramento, CA 94246-2460

12-3: Releasing Systems for Security Bars in Dwellings
1031.2.1

12-7-3: Fire-testing Furnaces
NA

12-7A-1: Exterior Wall Siding and Sheathing
703A.7, 707A.2

12-7A-2: Exterior Window
703A.7, 708A.2.1

12-7A-3: Under Eave
703A.7, 707A.8

12-7A-4: Decking:
703A.7, 709A.3

12-7A-4A: Decking Alternate Method A
703A.7, 709A.3

12-7A-5: Ignition Resistant Building Material
703A.7, 709A.3

12-8-100: Room Fire Tests for Wall and Ceiling Materials
408.14, 435.6.2

12-10-1: Power Operated Exit Doors
NA

12-10-2: Single Point Latching or Locking Devices
NA

12-10-3: Emergency Exit and Panic Hardware
NA

(The Office of the State Fire Marshal standards referred to above are found in the California Code of Regulations, Title 24, Part 12.):

SJI Steel Joist Institute, 140 Evans Street, Suite 203, Florence, SC 29501

SJI 100—2020: Standard Specification for K-Series, LH-Series, and DLH-Series Open Web Steel Joists and for Joist Girders
1604.3.3, 2207.1, 2207.2, 2207.3, 2207.4, 2207.5

SJI 200—2015: Standard Specification for CJ-Series Composite Steel Joists
1604.3.3, 2207.1, 2207.2, 2207.3, 2207.4, 2207.5

SPRI Single-Ply Roofing Industry, 465 Waverly Oaks Road, Suite 421, Waltham, MA 02452

ANSI/SPRI GT-1—2022: Test Standard for External Gutter Systems
1504.6.1, 1511.7.6.1

ANSI/SPRI RP-4—2019: Wind Design Standard for Ballasted Single-ply Roofing Systems
1504.5

ANSI/SPRI VF-1—2023: External Fire Design Standard for Vegetative Roofs
1505.10

ANSI/SPRI/FM 4435/ES-1—2017: Test Standard for Edge Systems Used with Low Slope Roofing Systems
1504.6, 1511.7.6.1

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SRCC Solar Rating & Certification Corporation, 400 High Point Drive, Suite 400, Cocoa, FL 32926

ICC 900/SRCC 300—2020: Solar Thermal System Standard
3111.2.1

ICC 901/SRCC 100—2020: Solar Thermal Collector Standard
3111.2.1

TIA Telecommunications Industry Association, 1320 N. Courthouse Road #200, Arlington, VA 22201

ANSI/TIA 222-I—2023: Structural Standard for Antenna Supporting Structures, Antennas and Small Wind Turbine Support Structures
1609.1.1, 3108.1, 3108.2

TMS The Masonry Society, 105 South Sunset Street, Suite Q, Longmont, CO 80501-6172

216—2014(19): Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
Table 721.1(2), 722.1

302—2018: Standard Method for Determining the Sound Transmission Ratings for Masonry Assemblies
1208.2.1

402—16: Building Code Requirements for Masonry Structures
2109.1, 2109.1.1, 2109.2

402—2022: Building Code Requirements for Masonry Structures
1404.7, 1404.11, *1413.2.2,* 1604.3.4, 1705.4, 1807.1.6.3.2, 1808.9, 2101.2, *2101.2.2, 2101A.1.3, 2104A.1.3,* 2103.2.4, *2103A.6, 2104A.1.3.10.2,* 2106.1, *2106A,* 2107.1, 2107.2, 2107.3, *2107.4, 2107A, 2107.5, 2107.6,* 2108.1, 2108.2, 2108.3, *2108.4,* 2110.1, 2114.1, 2114.4, *2115.1, 2115.2, 2115.5, 2115.6*

403—2017: Direct Design Handbook for Masonry Structures
2101.2

404—2023: Standard for the Design of Architectural Cast Stone
2101.2

504—2023: Standard for the Fabrication of Architectural Cast Stone
2103.1

602—2022: Specification for Masonry Structures
1404.7.1, 1705.4, *1705A.4,* 1705.4.1, 1807.1.6.3, *2101.2.2, 2101A.1.3,* 2103.1, 2103.2.1, 2103.3, *2103A.3.1,* 2103.4, 2104.1, *2104.2, 2104A,* 2105.1, *2105A.1, 2105.2, 2105A.2, 2105.3, 2105A.3, 2106.6, 2115.3, 2115.4*

604—2023: Standard for the Installation of Architectural Cast Stone
2104.1

TPI Truss Plate Institute, 2670 Crain Highway, Suite 203, Waldorf, MD 20601

ANSI/TPI 1—2022: National Design Standard for Metal Plate Connected Wood Truss Construction
2303.4.6, 2306.1

UBC International Code Council, Inc., 500 New Jersey Avenue, NW 6th Floor, Washington, DC 20001

UBC Standard 15-2: Test Standard for Determining the Fire Retardancy of Roof-Covering Materials
1505.6

UBC Standard 15-3: Wood Shakes
1505.6

UBC Standard 15-4: Wood Shingles
1505.6

UL UL LLC, 333 Pfingsten Road, Northbrook, IL 60062

9—2009: Fire Tests of Window Assemblies—with Revisions through March 2020
Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.2.1.3, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4, 1013.5

10A—2009: Tin Clad Fire Doors—with Revisions through July 20, 2018
716.2.1

10B—2008: Fire Tests of Door Assemblies—with Revisions through May 2020
Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.2, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1

10C—2016: Positive Pressure Fire Tests of Door Assemblies—with Revisions through May 2021
Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1, 1010.2.8.3

10D—2017: Fire Tests of Fire-Protective Curtain Assemblies
716.4

13—96: Power-limited Circuit Cables

14B—2008: Sliding Hardware for Standard Horizontally Mounted Tin Clad Fire Doors—with Revisions through September 2021
716.2.1

14C—2006: Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs—with Revisions through October 2021
716.2.1

38—99: Manually Actuated Signaling Boxes—with Revisions through February 2, 2005,* as amended.

Amend Section 14.1.5 as follows:

14.1.5 A signaling box having a glass panel, disc, rod or similar part that must be broken to operate it for a signal or for access to its actuating means shall satisfactorily complete five part-breaking operations using the means provided with the box, without jamming of the mechanism or other interference by broken particles. It shall be practicable to remove and replace the broken parts. A signaling box shall not have a glass panel, disc, rod or similar part requiring a striking action by grasping a tool to operate it for a signal. The force required to activate controls shall be no greater than 5 pounds (22 N) of force.

Add Appendix B chapter to UL 38 (1999) as follows:

Appendix B,

14.1.5 Operation. *Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.*

55A—2004: Materials for Built-up Roof Coverings
1507.10.2

96A-2016: Standard for Installation Requirements for Lightning Protection Systems
2703.2, 2703.2.1, 2703.3

103—2010: Factory-built Chimneys, for Residential Type and Building Heating Appliances—with Revisions through September 2021
718.2.5.1

127—2011: Factory-built Fireplaces—with Revisions through February 2020
718.2.5.1, 2111.12

193—04: Alarm Valves for Fire-Protection Service

199—95: Automatic Sprinklers for Fire Protection Service—with Revisions through August 19, 2005

199E—2004: Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers
904.14.4.1

217—2015: Smoke Alarms—with Revisions through April 2021
907.2.11

228—97: Door Closers/Holders, with or without Integral Smoke Detectors—with Revisions through January 26, 2006

260—04: Dry Pipe and Deluge Valves for Fire Protection Service

262—04: Gate Valves for Fire Protection Service

263—2011: Fire Tests of Building Construction and Materials—with Revisions through August 2021
703.2, 703.2.1.3, 703.2.1.5, 703.2.2, 703.4, 703.4, 704.11, 705.8, 707.6, 712.1.13.2, 714.4.1, 714.5.1, 715.3, Table 716.1(1), Table 716.1(3), 716.1.2.3, 716.2.5.1.1, 716.2.5.4, 716.3.2.1.1, 717.3.1, 717.5.2, 717.5.3, 717.6.1, 717.6.2, Table 721.1(1), 2103.1, 2603.5.1

268—2016: Smoke Detectors for Fire Alarm Systems—with Revisions through October 2019
407.9, 907.2.6.2, 907.2.11.7

268A—09: Smoke Detectors for Duct Application—with Revisions through October 22, 2003

294—2018: Access Control System Units—with Revisions through October 2018
1010.2.10, 1010.2.11, 1010.2.12.1, 1010.2.13

300—2019: Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment
904.14

300A—2006: Outline of Investigation for Extinguishing System Units for Residential Range Top Cooking Surfaces
904.15.1.1

305—2012: Panic Hardware—with Revisions through March 2017
1010.2.8.3

312—04: Check Valves for Fire-Protection Service

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325—2017: Door, Drapery, Gate, Louver and Window Operators and Systems—with Revisions through February 2020
406.2.1, 3110.3

346—05: Waterflow Indicators for Fire Protective Signaling Systems

464—03: Audible Signal Appliances—with Revisions through October 10, 2003

497B—04: Protectors for Data Communication and Fire Alarm Circuits

521—99: Heat Detectors for Fire Protective Signaling Systems—with Revisions through July 20, 2005

539—00: Single- and Multiple-Station Heat Detectors—with Revisions through August 15, 2005

555—2006: Fire Dampers—with Revisions through October 2020
717.3.1

555C—2014: Ceiling Dampers—with Revisions through January 2021
717.3.1

555S—2014: Smoke Dampers—with Revisions through October 2020
717.3.1

580—2006: Test for Uplift Resistance of Roof Assemblies—with Revisions through March 2019
1504.4.1, 1504.4.2

632—00: Electrically Actuated Transmitters

641—2010: Type L Low-temperature Venting Systems—with Revisions through April 2018
2113.11.1.4

710B—2011: Recirculating Systems—with Revisions through February 2019
904.14

723—2018: Standard for Test for Surface Burning Characteristics of Building Materials
202, 402.6.4.4, 406.7.2, 720.1, 720.4, 803.1.2, 803.5.2, 803.10, 803.11, 803.12, 803.13, 806.6, 1402.6, 1403.11.1, 1406.9, 1406.10.1, 1408.9, 1408.10.1, 1511.6.2, 1511.6.3, 2303.2, 2603.3, 2603.4.1.13, 2603.5.4, 2603.5.5, 2603.7, 2604.2.4, 2606.4, 2612.3, 2614.3, 3105.3

723S—2006: Drop-Out Ceilings Installed Beneath Automatic Sprinklers
2606.7.4

753—04: Alarm Accessories for Automatic Water Supply Valves for Fire Protection Service

790—*Edition 9—2022*: Standard Test Methods for Fire Tests of Roof Coverings—with Revisions through October 2018
1505.1, 2603.6, 2610.2, 2610.3

793—2008: Automatically Operated Roof Vents for Smoke and Heat—with Revisions through March 2017
910.3.1

813—96: Commercial Audio Equipment—with Revisions through December 7, 1999

857—13: Busways
1705A.14.3.1

864—2014: Control Units and Accessories for Fire Alarm Systems *as amended**—**with Revisions through May 2020**
909.12

****Amend No. 55.1 as follows:***

RETARD-RESET-RESTART PERIOD – MAXIMUM 30 SECONDS *—No alarm obtained from control unit. Maximum permissible time is 30 seconds.*

****Amend Section 55.2.2 as follows:***

Where an alarm verification feature is provided, the maximum retard-reset-restart period before an alarm signal can be confirmed and indicated at the control unit, including any control unit reset time and the power-up time for the detector to become operational for alarm, shall not exceed 30 seconds. (The balance of the section text is to remain unchanged).

****Add Section 55.2.9 as follows:***

Smoke detectors connected to an alarm verification feature shall not be used as releasing devices.

Exception: *Smoke detectors which operate their releasing function immediately upon alarm actuation independent of alarm verification feature.*

****Amend Section 89.1.10 as follows:***

The existing text of this section is to remain as printed with one editorial amendment as follows:

THE TOTAL DELAY (CONTROL UNIT PLUS SMOKE DETECTORS) SHALL NOT EXCEED 30 SECONDS.

(The balance of the section text is to remain unchanged).

924—2016: Emergency Lighting and Power Equipment—with Revisions through May 2020
1013.5

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1034-2011: Burglary-Resistant Electric Locking Mechanisms—with Revisions through June 2020
1010.2.10, 1010.2.11, 1010.2.12.1, 1010.2.13, 1010.2.14

1040—1996: Fire Test of Insulated Wall Construction—with Revisions through April 2017
1406.10.2, 2603.9

1256—2002: Fire Test of Roof Deck Construction—with Revisions through August 2018
1508.1, 2603.3, 2603.4.1.5

1479—2015: Fire Tests of Penetration Firestops—with Revisions through May 2021
202, 714.4.1.2, 714.4.2, 714.5.1.2, 714.5.4

1482—2011: Solid-fuel Type Room Heaters—with Revisions through February 2020
2112.2, 2112.5

1489—2016: Fire Tests of Fire Resistant Pipe Protection Systems Carrying Combustible Liquids—with Revisions through October 2021
403.4.8.2

1703—2002: Flat-plate Photovoltaic Modules and Panels—with Revisions through November 2019
➡ 3111.3.1

1715—1997: Fire Test of Interior Finish Material—with Revisions through April 2017
1406.10.2, 2603.9, 2614.4

1741—2010: Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources—with Revisions through June 2021
3111.3.1

1777—2015: Chimney Liners—with Revisions through April 2019
2113.11.1, 2113.19

1784—2015: Air Leakage Tests of Door Assemblies—with Revisions through February 2020
405.4.3, 710.5.2.2, 710.5.2.2.1, 716.2.1.4, 716.2.9.1, 716.2.9.3, 3006.3, 3007.6.3, 3008.6.3

1897—2015: Uplift Tests for Roof Covering Systems—with Revisions through September 2020
1504.4.1, 1504.4.3

1975—2006: Fire Tests for Foamed Plastics Used for Decorative Purposes
402.6.2, 402.6.4.5, 424.2

1994—2015: Luminous Egress Path Marking Systems—with Revisions through July 2020
411.6, 1008.2.1, 1025.2.1, 1025.2.3, 1025.2.4, 1025.2.5, 1025.4

2034—2017: Single and Multiple Station Carbon Monoxide Alarms—with Revisions through September 2018
915.4.2, 915.4.4

2075—2013: Gas and Vapor Detectors and Sensors—with Revisions through August 2021
915.5.1, 915.5.3

2079—2015: Tests for Fire Resistance of Building Joint Systems—with Revisions through July 2020
202, 715.3.1, 715.9

2196—2017: Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables—with Revisions through December 2020
909.20.7.1, 913.2.2, 2702.3, 3007.8.1, 3008.8.2

2200—2020: Stationary Engine Generator Assemblies
2702.1.1

2202—2009: Electric Vehicle (EV) Charging System Equipment—with Revisions through February 2018
406.2.7

2525—2020: Standard for Two-Way Emergency Communications Systems for Rescue Assistance
1009.8.1

2594—2016: Electric Vehicle Supply Equipment
406.2.7

2703—2014: Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-plate Photovoltaic Modules and Panels—with Revisions through March 2021
1505.9

7103—2019: Outline of Investigation for Building-Integrated Photovoltaic Roof Coverings
Table 1504.2, 1507.16.6, 1507.17.5

8802—2020: Outline of Investigation for Germicidal Systems
1211.1

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61730-1—2017: Photovoltaic (PV) Module Safety Qualification — Part 1: Requirements for Construction—with Revisions through April 2020
3111.3.1

61730-2—2017: Photovoltaic (PV) Module Safety Qualification — Part 2: Requirements for Testing—with Revisions through April 2020
3111.3.1

ULC Underwriters Laboratories of Canada, 13775 Commerce Parkway, Richmond, BC V6V 2V4

CAN/ULC S 102.2—2018: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
720.2, 720.3, 720.4

USC United States Code, 732 North Capitol Street NW, Washington, DC 20401-0003

18 USC Part 1, Ch. 40: Importation, Manufacture, Distribution and Storage of Explosive Materials
202

WCLIB West Coast Lumber Inspection Bureau, P.O. Box 23145, Portland, OR 97223

AITC 104—03: Typical Construction Details
2306.1

AITC 110—01: Standard Appearance Grades for Structural Glued Laminated Timber
2306.1

AITC 111—05: Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
2303.1.3.1

AITC 113—10: Standard for Dimensions of Structural Glued Laminated Timber
2306.1

AITC 119—96: Standard Specifications for Structural Glued Laminated Timber of Hardwood Species
2306.1

AITC 200—20: Manufacturing Quality Control Systems Manual for Structural Glued Laminated Timber
2306.1

AITC 404—05: Standard for Radially Reinforcing Curved Glued Laminated Timber Members to Resist Radial Tension
2303.1.3.1

WDMA Window and Door Manufacturers Association, 2025 M Street NW, Suite 800, Washington, DC 20006

AAMA/WDMA/CSA 101/I.S.2/A440—22: North American Fenestration Standard/Specification for Windows, Doors, and Skylights
1709.5.1, 2405.5

WDMA I.S. 11—2018: Industry Standard for Analytical Method for Design Pressure (DP) Ratings of Fenestration Products
1709.5

WRI Wire Reinforcement Institute, Inc., 942 Main Street, Suite 300, Hartford, CT 06103

WRI/CRSI—81: Design of Slab-on-ground Foundations—with 1996 Update
1808.6.2

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX A – EMPLOYEE QUALIFICATIONS

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

A

EMPLOYEE QUALIFICATIONS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix A provides optional criteria for the qualifications for jurisdictions to consider when hiring personnel to enforce the building code. Criteria for the building official, plan reviewers and inspectors are provided.

ICC code development note: Code change proposals to this appendix will be considered by the Administrative Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION A101—BUILDING OFFICIAL QUALIFICATIONS

[A] A101.1 Building official. The building official shall have not fewer than 10 years' experience or equivalent as an architect, engineer, inspector, contractor or superintendent of construction, or any combination of these, 5 years of which shall have been supervisory experience. The building official should be certified as a building official through a recognized certification program. The building official shall be appointed or hired by the applicable governing authority.

[A] A101.2 Chief inspector. The building official can designate supervisors to administer the provisions of this code and the *California Mechanical Code, California Plumbing Code* and *International Fuel Gas Code.* Each supervisor shall have not fewer than 10 years experience or equivalent as an architect, engineer, inspector, contractor or superintendent of construction, or any combination of these, 5 years of which shall have been in a supervisory capacity. They shall be certified through a recognized certification program for the appropriate trade.

[A] A101.3 Inspector and plans examiner. The building official shall appoint or hire such number of officers, inspectors, assistants and other employees as shall be authorized by the jurisdiction. A person who has fewer than 5 years of experience as a contractor, engineer, architect, or as a superintendent, foreman or competent mechanic in charge of construction shall not be appointed or hired as inspector of construction or plans examiner. The inspector or plans examiner shall be certified through a recognized certification program for the appropriate trade.

[A] A101.4 Termination of employment. Employees in the position of building official, chief inspector or inspector shall not be removed from office except for cause after full opportunity has been given to be heard on specific charges before such applicable governing authority.

SECTION A102—REFERENCED STANDARDS

[A] A102.1 General. See Table A102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE A102.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CBC—*25*	*California Building Code*	A101.2
CMC—*25*	*California Mechanical Code*	A101.2
CPC—*25*	*California Plumbing Code*	A101.2
IFGC—24	*International Fuel Gas Code*	A101.2

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX B – BOARD OF APPEALS

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

B

BOARD OF APPEALS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix B provides criteria for Board of Appeals members. Also provided are procedures by which the Board of Appeals should conduct its business.

ICC code development note: Code change proposals to this appendix will be considered by the Administrative Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION B101—GENERAL

[A] B101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 113. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the building official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

[A] B101.2 Application for appeal. Any person shall have the right to appeal a decision of the building official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the building official within 20 days after the notice was served.

[A] B101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] B101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

[A] B101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for **[INSERT NUMBER OF YEARS]** years or until a successor has been appointed. The board members' terms shall be staggered at intervals, so as to provide continuity. The building official shall be an ex officio member of said board but shall not vote on any matter before the board.

[A] B101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

[A] B101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

[A] B101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

[A] B101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

[A] B101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] B101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] B101.3.7 Compensation of members. Compensation of members shall be determined by law.

[A] B101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their term only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

[A] B101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

[A] B101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

[A] B101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the building official and any person whose interests are affected shall be given an opportunity to be heard.

[A] B101.5.2 Quorum. Three members of the board shall constitute a quorum.

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[A] B101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

[A] B101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

[A] B101.7 Board decision. The board shall only modify or reverse the decision of the building official by a concurring vote of three or more members.

[A] B101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the building official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the building official.

[A] B101.7.2 Administration. The building official shall take immediate action in accordance with the decision of the board.

[A] B101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX C – GROUP U – AGRICULTURAL BUILDINGS

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

C

GROUP U—AGRICULTURAL BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Agricultural buildings are given special consideration in Appendix C. Often such buildings have unique uses and structural needs. Where an agricultural building is surrounded by 60 feet of open area on all sides, size limits are waived. Automatic sprinkler protection may be required.

ICC code development note: Code change proposals to sections in this appendix will be considered by the IBC-General Code Development committee during the 2025 (Group B) Code Development Cycle.

SECTION C101—GENERAL

C101.1 Scope. The provisions of this appendix shall apply exclusively to agricultural buildings. Such buildings shall be classified as Group U and shall include the following uses:

1. Livestock shelters or buildings, including shade structures and milking barns.
2. Poultry buildings or shelters.
3. Barns.
4. Storage of equipment and machinery used exclusively in agriculture.
5. Horticultural structures, including detached production greenhouses and crop protection shelters.
6. Sheds.
7. Grain silos.
8. Stables.

SECTION C102—ALLOWABLE HEIGHT AND AREA

C102.1 General. Buildings classified as Group U Agricultural shall not exceed the area or height limits specified in Table C102.1.

TABLE C102.1—BASIC ALLOWABLE AREA FOR A GROUP U, ONE STORY IN HEIGHT AND MAXIMUM HEIGHT OF SUCH OCCUPANCY

I		II		III and IV		V	
A	B	A	B	III A and IV	III B	A	B
ALLOWABLE AREA (square feet)[a]							
Unlimited	60,000	27,100	18,000	27,100	18,000	21,100	12,000
MAXIMUM HEIGHT IN STORIES							
Unlimited	12	4	2	4	2	3	2
MAXIMUM HEIGHT IN FEET							
Unlimited	160	65	55	65	55	50	40

For SI: 1 square foot = 0.0929 m^2.

a. See Section C102 for unlimited area under certain conditions.

C102.2 One-story unlimited area. The area of a one-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

C102.3 Two-story unlimited area. The area of a two-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width and is provided with an approved automatic sprinkler system throughout in accordance with Section 903.3.1.1.

SECTION C103—MIXED OCCUPANCIES

C103.1 Mixed occupancies. Mixed occupancies shall be protected in accordance with Section 508.

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SECTION C104—EXITS

C104.1 Exit facilities. Exits shall be provided in accordance with *Chapter 11A or 11B as applicable.*

Exceptions:

1. The maximum travel distance from any point in the building to an approved exit shall not exceed 300 feet (91 440 mm).
2. One exit is required for each 15,000 square feet (1393.5 m^2) of area or fraction thereof.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX D – FIRE DISTRICTS

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

D

FIRE DISTRICTS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix D establishes a framework by which a jurisdiction can establish a portion of a jurisdiction as a fire district. Fire districts are often designated in a more densely developed portion of a city where limiting the potential spread of fire is a key consideration. Specific construction types and users are prohibited in a fire district.

ICC code development note: Code change proposals to sections in this appendix will be considered by the IBC-General Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION D101—GENERAL

D101.1 Scope. The fire district shall include such territory or portion as outlined in an ordinance or law entitled "An Ordinance (Resolution) Creating and Establishing a Fire District." Wherever, in such ordinance creating and establishing a fire district, reference is made to the fire district, it shall be construed to mean the fire district designated and referred to in this appendix.

D101.1.1 Mapping. The fire district complying with the provisions of Section D101.1 shall be shown on a map that shall be available to the public.

D101.2 Establishment of area. For the purpose of this code, the fire district shall include that territory or area as described in Sections D101.2.1 through D101.2.3.

D101.2.1 Adjoining blocks. Two or more adjoining blocks, exclusive of intervening streets, where not less than 50 percent of the ground area is built upon and more than 50 percent of the built-on area is devoted to hotels and motels of Group R-1; Group B occupancies; theaters, nightclubs, restaurants of Group A-1 and A-2 occupancies; garages, express and freight depots, warehouses and storage buildings used for the storage of finished products (not located with and forming a part of a manufactured or industrial plant); or Group S occupancy. Where the average height of a building is two and one-half stories or more, a block should be considered if the ground area built upon is not less than 40 percent.

D101.2.2 Buffer zone. Where four contiguous blocks or more comprise a fire district, there shall be a buffer zone of 200 feet (60 960 mm) around the perimeter of such district. Streets, rights-of-way and other open spaces not subject to building construction can be included in the 200- foot (60 960 mm) buffer zone.

D101.2.3 Developed blocks. Where blocks adjacent to the fire district have developed to the extent that not less than 25 percent of the ground area is built upon and 40 percent or more of the built-on area is devoted to the occupancies specified in Section D101.2.1, they can be considered for inclusion in the fire district, and can form all or a portion of the 200-foot (60 960 mm) buffer zone required in Section D101.2.2.

SECTION D102—BUILDING RESTRICTIONS

D102.1 Types of construction permitted. Within the fire district every building hereafter erected shall be Type I, II, III or IV, except as permitted in Section D104.

D102.2 Other specific requirements.

D102.2.1 Exterior walls. Exterior walls of buildings located in the fire district shall comply with the requirements in Table 601 except as required in Section D102.2.6.

D102.2.2 Group H prohibited. Group H occupancies shall be prohibited from location within the fire district.

D102.2.3 Construction type. Every building shall be constructed as required based on the type of construction indicated in Chapter 6.

D102.2.4 Roof covering. Roof covering in the fire district shall conform to the requirements of Class A or B roof coverings as defined in Section 1505.

D102.2.5 Structural fire rating. Walls, floors, roofs and their supporting structural members shall be not less than 1-hour fire-resistance-rated construction.

Exceptions:

1. Buildings of Type IV-HT construction.
2. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Automobile parking structures.
4. Buildings surrounded on all sides by a permanently open space of not less than 30 feet (9144 mm).
5. Partitions complying with Section 603.1, Item 11.

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D102.2.6 Exterior walls. Exterior load-bearing walls of Type II buildings shall have a fire-resistance rating of 2 hours or more where such walls are located within 30 feet (9144 mm) of a common property line or an assumed property line. Exterior nonload-bearing walls of Type II buildings located within 30 feet (9144 mm) of a common property line or an assumed property line shall have fire-resistance ratings as required by Table 601, but not less than 1 hour. Exterior walls located more than 30 feet (9144 mm) from a common property line or an assumed property line shall comply with Table 601.

Exception: In the case of one-story buildings that are 2,000 square feet (186 m^2) or less in area, exterior walls located more than 15 feet (4572 mm) from a common property line or an assumed property line need only comply with Table 601.

D102.2.7 Architectural trim. Architectural trim on buildings located in the fire district shall be constructed of approved noncombustible materials or fire-retardant-treated wood.

D102.2.8 Permanent canopies. Permanent canopies are permitted to extend over adjacent open spaces provided that all of the following are met:

1. The canopy and its supports shall be of noncombustible material, fire-retardant-treated wood, Type IV construction or of 1-hour fire-resistance-rated construction.

   Exception: Any textile covering for the canopy shall be flame resistant as determined by tests conducted in accordance with NFPA 701 after both accelerated water leaching and accelerated weathering.
2. Any canopy covering, other than textiles, shall have a flame spread index not greater than 25 when tested in accordance with ASTM E84 or UL 723 in the form intended for use.
3. The canopy shall have one long side open.
4. The maximum horizontal width of the canopy shall be not greater than 15 feet (4572 mm).
5. The fire resistance of exterior walls shall not be reduced.

D102.2.9 Roof structures. Structures, except aerial supports 12 feet (3658 mm) high or less, flagpoles, water tanks and cooling towers, placed above the roof of any building within the fire district shall be of noncombustible material and shall be supported by construction of noncombustible material.

D102.2.10 Plastic signs. The use of plastics complying with Section 2611 for signs is permitted provided that the structure of the sign in which the plastic is mounted or installed is noncombustible.

D102.2.11 Plastic veneer. Exterior plastic veneer is not permitted in the fire district.

SECTION D103—CHANGES TO BUILDINGS

D103.1 Existing buildings within the fire district. An existing building shall not be increased in height or area unless it is of a type of construction permitted for new buildings within the fire district or is altered to comply with the requirements for such type of construction. Nor shall any existing building be extended on any side, nor square footage or floors added within the existing building unless such modifications are of a type of construction permitted for new buildings within the fire district.

D103.2 Other alterations. Nothing in Section D103.1 shall prohibit other alterations within the fire district provided that such alterations do not create a change of occupancy that is otherwise prohibited or increase the fire hazard.

D103.3 Moving buildings. Buildings shall not hereafter be moved into the fire district or to another lot in the fire district unless the building is of a type of construction permitted in the fire district.

SECTION D104—BUILDINGS LOCATED PARTIALLY IN THE FIRE DISTRICT

D104.1 General. Any building located partially in the fire district shall be of a type of construction required for the fire district, unless the major portion of such building lies outside of the fire district and all portions of it extend not more than 10 feet (3048 mm) inside the boundaries of the fire district.

SECTION D105—EXCEPTIONS TO RESTRICTIONS IN FIRE DISTRICT

D105.1 General. The preceding provisions of this appendix shall not apply in the following instances:

1. Temporary buildings used in connection with duly authorized construction.
2. A private garage used exclusively as such, not more than one story in height, nor more than 650 square feet (60 m^2) in area, located on the same lot with a dwelling.
3. Fences not over 8 feet (2438 mm) high.
4. Coal tipples, material bins and trestles of Type IV construction.
5. Water tanks and cooling towers conforming to Sections 1510.3 and 1510.4.
6. Greenhouses less than 15 feet (4572 mm) high.
7. Porches on dwellings not over one story in height, and not over 10 feet (3048 mm) wide from the face of the building, provided that such porch does not come within 5 feet (1524 mm) of any property line.
8. Sheds open on a long side not over 15 feet (4572 mm) high and 500 square feet (46 m^2) in area.
9. One- and two-family dwellings where of a type of construction not permitted in the fire district can be extended 25 percent of the floor area existing at the time of inclusion in the fire district by any type of construction permitted by this code.

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10. Wood decks less than 600 square feet (56 m^2) where constructed of 2-inch (51 mm) nominal wood, pressure treated for exterior use.
11. Wood veneers on exterior walls conforming to Section 1404.6.
12. Exterior plastic veneer complying with Section 2605.2 where installed on exterior walls required to have a fire-resistance rating not less than 1 hour, provided that the exterior plastic veneer does not exhibit sustained flaming as defined in NFPA 268.

SECTION D106—REFERENCED STANDARDS

D106.1 General. See Table D106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE D106.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM E84—21A	*Standard Test Method for Surface Burning Characteristics of Building Materials*	D102.2.8
NFPA 268—22	*Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source*	D105.1
NFPA 701—23	*Standard Methods of Fire Tests for Flame-Propagation of Textiles and Films*	D102.2.8
UL 723—2018	*Standard for Test for Surface Burning Characteristics of Building Materials*	D102.2.8

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APPENDIX

E

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX F – RODENTPROOFING

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

F

RODENTPROOFING

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: The provisions of Appendix F are minimum mechanical methods to prevent the entry of rodents into a building. These standards, when used in conjunction with cleanliness and maintenance programs, can significantly reduce the potential of rodents invading a building.

ICC code development note: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION F101—GENERAL

F101.1 General. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed in accordance with the provisions of this section.

F101.2 Foundation wall ventilation openings. Foundation wall ventilation openings shall be covered for their height and width with perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick, expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick, cast-iron grills or grating, extruded aluminum load-bearing vents or with hardware cloth of 0.035 inch (0.89 mm) wire or heavier. The openings therein shall not exceed $^1/_4$ inch (6.4 mm).

F101.3 Foundation and exterior wall sealing. Annular spaces around pipes, electric cables, conduits or other openings in the walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry or noncorrosive metal.

F101.4 Doors. Doors on which metal protection has been applied shall be hinged so as to be free swinging. When closed, the maximum clearance between any door, door jambs and sills shall be not greater than $^3/_8$ inch (9.5 mm).

F101.5 Windows and other openings. Windows and other openings for the purpose of light or ventilation located in exterior walls within 2 feet (610 mm) above the existing ground level immediately below such opening shall be covered for their entire height and width, including frame, with hardware cloth of not less than 0.035-inch (0.89 mm) wire or heavier.

F101.5.1 Rodent-accessible openings. Windows and other openings for the purpose of light and ventilation in the exterior walls not covered in this chapter, accessible to rodents by way of exposed pipes, wires, conduits and other appurtenances, shall be covered with wire cloth of at least 0.035-inch (0.89 mm) wire. In lieu of wire cloth covering, said pipes, wires, conduits and other appurtenances shall be blocked from rodent usage by installing solid sheet metal guards 0.024 inch (0.61 mm) thick or heavier. Guards shall be fitted around pipes, wires, conduits or other appurtenances. In addition, they shall be fastened securely to and shall extend perpendicularly from the exterior wall for not less than 12 inches (305 mm) beyond and on either side of pipes, wires, conduits or appurtenances.

F101.6 Pier and wood construction.

F101.6.1 Sill less than 12 inches above ground. Buildings not provided with a continuous foundation shall be provided with protection against rodents at grade by providing either an apron in accordance with Section F101.6.1.1 or a floor slab in accordance with Section F101.6.1.2.

F101.6.1.1 Apron. Where an apron is provided, the apron shall be not less than 8 inches (203 mm) above, nor less than 24 inches (610 mm) below, grade. The apron shall not terminate below the lower edge of the siding material. The apron shall be constructed of an approved nondecayable, water-resistant rodentproofing material of required strength and shall be installed around the entire perimeter of the building. Where constructed of masonry or concrete materials, the apron shall be not less than 4 inches (102 mm) in thickness.

F101.6.1.2 Grade floors. Where continuous concrete-grade floor slabs are provided, open spaces shall not be left between the slab and walls, and openings in the slab shall be protected.

F101.6.2 Sill at or above 12 inches above ground. Buildings not provided with a continuous foundation and that have sills 12 inches (305 mm) or more above ground level shall be provided with protection against rodents at grade in accordance with any of the following:

1. Section F101.6.1.1 or F101.6.1.2.
2. By installing solid sheet metal collars not less than 0.024 inch (0.6 mm) thick at the top of each pier or pile and around each pipe, cable, conduit, wire or other item that provides a continuous pathway from the ground to the floor.
3. By encasing the pipes, cables, conduits or wires in an enclosure constructed in accordance with Section F101.6.1.1.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX G – FLOOD-RESISTANT CONSTRUCTION

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

G

FLOOD-RESISTANT CONSTRUCTION

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix G is intended to provide the additional flood-plain management and administrative requirements of the National Flood Insurance Program (NFIP) that are not included in the code. Communities that adopt the *California Building Code* and Appendix G will meet the minimum requirements of NFIP as set forth in Title 44 of the Code of Federal Regulations.

ICC code development note: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION G101—ADMINISTRATION

G101.1 Purpose. The purpose of this appendix is to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific flood hazard areas through the establishment of comprehensive regulations for management of flood hazard areas designed to:

1. Prevent unnecessary disruption of commerce, access and public service during times of flooding.
2. Manage the alteration of natural flood plains, stream channels and shorelines.
3. Manage filling, grading, dredging and other development that may increase flood damage or erosion potential.
4. Prevent or regulate the construction of flood barriers that will divert floodwaters or that can increase flood hazards.
5. Contribute to improved construction techniques in the flood plain.

G101.2 Objectives. The objectives of this appendix are to protect human life, minimize the expenditure of public money for flood control projects, minimize the need for rescue and relief efforts associated with flooding, minimize prolonged business interruption, minimize damage to public facilities and utilities, help maintain a stable tax base by providing for the sound use and development of flood-prone areas, contribute to improved construction techniques in the flood plain and ensure that potential owners and occupants are notified that property is within flood hazard areas.

G101.3 Scope. The provisions of this appendix shall apply to all proposed development in a flood hazard area established in Section 1612 of this code, including certain building work exempt from permit under Section 105.2.

G101.4 Violations. Any violation of a provision of this appendix, or failure to comply with a permit or variance issued pursuant to this appendix or any requirement of this appendix, shall be handled in accordance with Section 114.

G101.5 Designation of floodplain administrator. The **[INSERT JURISDICTION'S SELECTED POSITION TITLE]** is designated as the floodplain administrator and is authorized and directed to enforce the provisions of this appendix. The floodplain administrator is authorized to delegate performance of certain duties to other employees of the jurisdiction. Such designation shall not alter any duties and powers of the building official.

SECTION G102—DEFINITIONS

G102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

DEVELOPMENT. Any man-made change to improved or unimproved real estate, including but not limited to, buildings or other structures, temporary structures, temporary or permanent storage of materials, mining, dredging, filling, grading, paving, excavations, operations and other land-disturbing activities.

FUNCTIONALLY DEPENDENT FACILITY. A facility that cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities necessary for the loading or unloading of cargo or passengers, and shipbuilding and ship repair facilities. The term does not include long-term storage, manufacture, sales or service facilities.

MANUFACTURED HOME. A structure that is transportable in one or more sections, built on a permanent chassis, designed for use with or without a permanent foundation when attached to the required utilities, and constructed to the Federal Manufactured Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development. The term also includes mobile homes, park trailers, travel trailers and similar transportable structures that are placed on a site for 180 consecutive days or longer.

MANUFACTURED HOME PARK OR SUBDIVISION. A parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

RECREATIONAL VEHICLE. A vehicle that is built on a single chassis, 400 square feet (37.16 m^2) or less when measured at the largest horizontal projection, designed to be self-propelled or permanently towable by a light-duty truck, and designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel or seasonal use. A recreational vehicle is

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ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect-type utilities and security devices and has no permanently attached additions.

VARIANCE. A grant of relief from the requirements of this section that permits construction in a manner otherwise prohibited by this section where specific enforcement would result in unnecessary hardship.

VIOLATION. A development that is not fully compliant with this appendix or Section 1612, as applicable.

SECTION G103—APPLICABILITY

G103.1 General. This appendix, in conjunction with this code, provides minimum requirements for development located in flood hazard areas, including:

1. The subdivision of land.
2. Site improvements and installation of utilities.
3. Placement and replacement of manufactured homes.
4. Placement of recreational vehicles.
5. New construction and repair, reconstruction, rehabilitation or additions to new construction.
6. Substantial improvement of existing buildings and structures, including restoration after damage.
7. Installation of tanks.
8. Temporary structures.
9. Temporary or permanent storage, utility and miscellaneous Group U buildings and structures.
10. Certain building work exempt from permit under Section 105.2 and other buildings and development activities.

G103.2 Establishment of flood hazard areas. Flood hazard areas are established in Section 1612.3 of this code, adopted by the applicable governing authority on **[INSERT DATE]**.

SECTION G104—POWERS AND DUTIES

G104.1 Permit applications. All applications for permits shall comply with the following:

1. The floodplain administrator shall review all permit applications to determine whether proposed development is located in flood hazard areas established in Section G103.2.
2. Where a proposed development site is in a flood hazard area, all development to which this appendix is applicable as specified in Section G103.1 shall be designed and constructed with methods, practices and materials that minimize flood damage and that are in accordance with this code and ASCE 24.

G104.2 Other permits. It shall be the responsibility of the floodplain administrator to ensure that approval of a proposed development shall not be given until proof that necessary permits have been granted by federal or state agencies having jurisdiction over such development.

G104.3 Determination of design flood elevations. If design flood elevations are not specified, the floodplain administrator is authorized to require the applicant to meet one of the following:

1. Obtain, review and reasonably utilize data available from a federal, state or other source.
2. Determine the design flood elevation in accordance with accepted hydrologic and hydraulic engineering techniques. Such analyses shall be performed and sealed by a registered design professional. Studies, analyses and computations shall be submitted in sufficient detail to allow review and approval by the floodplain administrator. The accuracy of data submitted for such determination shall be the responsibility of the applicant.

G104.4 Activities in riverine flood hazard areas. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the floodplain administrator shall not permit any new construction, substantial improvement or other development, including fill, unless the applicant submits an engineering analysis prepared by a registered design professional, demonstrating that the cumulative effect of the proposed development, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the community.

G104.5 Floodway encroachment. Prior to issuing a permit for any floodway encroachment, including fill, new construction, substantial improvements and other development or land-disturbing activity, the floodplain administrator shall require submission of a certification, prepared by a registered design professional, along with supporting technical data, demonstrating that such development will not cause any increase of the base flood level.

G104.5.1 Floodway revisions. A floodway encroachment that increases the level of the base flood is authorized if the applicant has applied for a conditional Flood Insurance Rate Map (FIRM) revision and has received the approval of the Federal Emergency Management Agency (FEMA).

G104.6 Watercourse alteration. Prior to issuing a permit for any alteration or relocation of any watercourse, the floodplain administrator shall require the applicant to provide notification of the proposal to the appropriate authorities of all adjacent government jurisdictions, as well as appropriate state agencies. A copy of the notification shall be maintained in the permit records and submitted to FEMA.

G104.6.1 Engineering analysis. The floodplain administrator shall require submission of an engineering analysis, prepared by a registered design professional, demonstrating that the flood-carrying capacity of the altered or relocated portion of the watercourse will not be decreased. Such watercourses shall be maintained in a manner that preserves the channel's flood-carrying capacity.

G104.7 Alterations in coastal areas. Prior to issuing a permit for any alteration of sand dunes and mangrove stands in coastal high-hazard areas and coastal A zones, the floodplain administrator shall require submission of an engineering analysis, prepared by a registered design professional, demonstrating that the proposed alteration will not increase the potential for flood damage.

G104.8 Records. The floodplain administrator shall maintain a permanent record of all permits issued in flood hazard areas, including supporting certifications and documentation required by this appendix and copies of inspection reports, design certifications and documentation of elevations required in Section 1612 of this code and Section R306 of the *California Residential Code*.

G104.9 Inspections. Development for which a permit under this appendix is required shall be subject to inspection. The floodplain administrator or the floodplain administrator's designee shall make, or cause to be made, inspections of all development in flood hazard areas authorized by issuance of a permit under this appendix.

G104.10 Use of changed technical data. The floodplain administrator and the applicant shall not use changed flood hazard area boundaries or base flood elevations for proposed buildings or developments unless the floodplain administrator or applicant has applied for a conditional Flood Insurance Rate Map (FIRM) revision and has received the approval of the Federal Emergency Management Agency (FEMA).

SECTION G105—PERMITS

G105.1 Required. Any person, owner or owner's authorized agent who intends to conduct any development in a flood hazard area shall first make application to the floodplain administrator and shall obtain the required permit.

G105.2 Application for permit. The applicant shall file an application in writing on a form furnished by the floodplain administrator. Such application shall:

1. Identify and describe the development to be covered by the permit.
2. Describe the land on which the proposed development is to be conducted by legal description, street address or similar description that will readily identify and definitely locate the site.
3. Include a site plan showing the delineation of flood hazard areas, floodway boundaries, flood zones, design flood elevations, ground elevations, proposed fill and excavation and drainage patterns and facilities.
4. Include in subdivision proposals and other proposed developments with more than 50 lots or larger than 5 acres (20 234 m^2), base flood elevation data in accordance with Section 1612.3.1 if such data are not identified for the flood hazard areas established in Section G103.2.
5. Indicate the use and occupancy for which the proposed development is intended.
6. Be accompanied by construction documents, grading and filling plans and other information deemed appropriate by the floodplain administrator.
7. State the valuation of the proposed work.
8. Be signed by the applicant or the applicant's authorized agent.

G105.3 Validity of permit. The issuance of a permit under this appendix shall not be construed to be a permit for, or approval of, any violation of this appendix or any other ordinance of the jurisdiction. The issuance of a permit based on submitted documents and information shall not prevent the floodplain administrator from requiring the correction of errors. The floodplain administrator is authorized to prevent occupancy or use of a structure or site that is in violation of this appendix or other ordinances of this jurisdiction.

G105.4 Expiration. A permit shall become invalid if the proposed development is not commenced within 180 days after its issuance, or if the work authorized is suspended or abandoned for a period of 180 days after the work commences. Extensions shall be requested in writing and justifiable cause demonstrated. The floodplain administrator is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each.

G105.5 Suspension or revocation. The floodplain administrator is authorized to suspend or revoke a permit issued under this appendix wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or code of this jurisdiction.

SECTION G106—VARIANCES

G106.1 General. The board of appeals established pursuant to Section 113, or other established or designed board, shall hear and decide requests for variances. The board shall base its determination on technical justifications, and has the right to attach such conditions to variances as it deems necessary to further the purposes and objectives of this appendix and Section 1612.

G106.2 Records. The floodplain administrator shall maintain a permanent record of all variance actions, including justification for their issuance.

G106.3 Historic structures. A variance is authorized to be issued for the repair or rehabilitation of a historic structure upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure, and the variance is the minimum necessary to preserve the historic character and design of the structure.

Exception: Within flood hazard areas, historic structures that do not meet one or more of the following designations:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.
2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

G106.4 Functionally dependent facilities. A variance is authorized to be issued for the construction or substantial improvement of a functionally dependent facility provided that the criteria in Section 1612.1 are met and the variance is the minimum necessary to allow the construction or substantial improvement, and that all due consideration has been given to methods and materials that minimize flood damages during the design flood and do not create additional threats to public safety.

G106.5 Restrictions. The board shall not issue a variance for any proposed development in a floodway if any increase in flood levels would result during the base flood discharge.

G106.6 Considerations. In reviewing applications for variances, the board shall consider all technical evaluations, all relevant factors, all other portions of this appendix and the following:

1. The danger that materials and debris may be swept onto other lands resulting in further injury or damage.
2. The danger to life and property due to flooding or erosion damage.
3. The susceptibility of the proposed development, including contents, to flood damage and the effect of such damage on current and future owners.
4. The importance of the services provided by the proposed development to the community.
5. The availability of alternate locations for the proposed development that are not subject to flooding or erosion.
6. The compatibility of the proposed development with existing and anticipated development.
7. The relationship of the proposed development to the comprehensive plan and flood plain management program for that area.
8. The safety of access to the property in times of flood for ordinary and emergency vehicles.
9. The expected heights, velocity, duration, rate of rise and debris and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site.
10. The costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water systems, streets and bridges.

G106.7 Conditions for issuance. Variances shall only be issued by the board where all of the following criteria are met:

1. A technical showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site renders the elevation standards inappropriate.
2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable.
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, nor create nuisances, cause fraud on or victimization of the public or conflict with existing local laws or ordinances.
4. A determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.
5. Notification to the applicant in writing over the signature of the floodplain administrator that the issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance up to amounts as high as $25 for $100 of insurance coverage, and that such construction below the base flood level increases risks to life and property.

SECTION G107—SUBDIVISIONS

G107.1 General. Any subdivision proposal, including proposals for manufactured home parks and subdivisions, or other proposed new development in a flood hazard area shall be reviewed to verify all of the following:

1. Such proposals are consistent with the need to minimize flood damage.
2. Public utilities and facilities, such as sewer, gas, electric and water systems, are located and constructed to minimize or eliminate flood damage.
3. Adequate drainage is provided to reduce exposure to flood hazards.

G107.2 Subdivision requirements. The following requirements shall apply in the case of any proposed subdivision, including proposals for manufactured home parks and subdivisions, any portion of which lies within a flood hazard area:

1. The flood hazard area, including floodways, coastal high-hazard areas and coastal A zones, as appropriate, shall be delineated on tentative and final subdivision plats.
2. Design flood elevations shall be shown on tentative and final subdivision plats.
3. Residential building lots shall be provided with adequate buildable area outside the floodway.
4. The design criteria for utilities and facilities set forth in this appendix and appropriate International Codes shall be met.

SECTION G108—SITE IMPROVEMENT

G108.1 Development in floodways. Development or land-disturbing activity shall not be authorized in the floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice, and prepared by a registered design professional, that the proposed encroachment will not result in any increase in the base flood level.

G108.2 Coastal high-hazard areas and coastal A zones. In coastal high-hazard areas and coastal A zones:

1. New buildings and buildings that are substantially improved shall only be authorized landward of the reach of mean high tide.
2. The use of fill for structural support of buildings is prohibited.

G108.3 Sewer facilities. All new or replaced sanitary sewer facilities, private sewage treatment plants (including all pumping stations and collector systems) and on-site waste disposal systems shall be designed in accordance with Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the facilities and discharge from the facilities into floodwaters, or impairment of the facilities and systems.

G108.4 Water facilities. All new or replacement water facilities shall be designed in accordance with the provisions of Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the systems.

G108.5 Storm drainage. Storm drainage shall be designed to convey the flow of surface waters to minimize or eliminate damage to persons or property.

G108.6 Streets and sidewalks. Streets and sidewalks shall be designed to minimize potential for increasing or aggravating flood levels.

SECTION G109—MANUFACTURED HOMES

G109.1 Elevation. All new and replacement manufactured homes to be placed or substantially improved in a flood hazard area shall be elevated such that the top of the foundation for the manufactured home is at or above the design flood elevation.

G109.2 Foundations. All new and replacement manufactured homes, including substantial improvement of existing manufactured homes, shall be placed on a permanent, reinforced foundation that is designed in accordance with Section R306 of the *California Residential Code*.

G109.3 Anchoring. All new and replacement manufactured homes to be placed or substantially improved in a flood hazard area shall be installed using methods and practices that minimize flood damage. Manufactured homes shall be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement. Methods of anchoring are authorized to include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

G109.4 Protection of mechanical equipment and outside appliances. Mechanical equipment and outside appliances shall be elevated to or above the design flood elevation.

Exception: Where such equipment and appliances are designed and installed to prevent water from entering or accumulating within their components and the systems are constructed to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to the elevation required by Section R306 of the *California Residential Code*, the systems and equipment shall be permitted to be located below the elevation required by Section R306 of the *California Residential Code*. Electrical wiring systems shall be permitted below the design flood elevation provided that they conform to the provisions of *the California Electrical Code.*

G109.5 Enclosures. Fully enclosed areas below elevated manufactured homes shall comply with the requirements of Section R306 of the *California Residential Code*.

SECTION G110—RECREATIONAL VEHICLES

G110.1 Placement prohibited. The placement of recreational vehicles shall not be authorized in coastal high-hazard areas and in floodways.

G110.2 Temporary placement. Recreational vehicles in flood hazard areas shall be fully licensed and ready for highway use, or shall be placed on a site for less than 180 consecutive days.

G110.3 Permanent placement. Recreational vehicles that are not fully licensed and ready for highway use, or that are to be placed on a site for more than 180 consecutive days, shall meet the requirements of Section G109 for manufactured homes.

SECTION G111—TANKS

G111.1 Tanks. Underground and above-ground tanks shall be designed, constructed, installed and anchored in accordance with ASCE 24.

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SECTION G112—OTHER BUILDING WORK

G112.1 Garages and accessory structures. Garages and accessory structures shall be designed and constructed in accordance with ASCE 24, subject to the following limitations:

1. In flood hazard areas other than coastal high-hazard areas and coastal A Zones, the floors of detached garages and detached accessory storage structures are permitted below the elevations specified in ASCE 24, provided that such structures are used solely for parking or storage, are one story and not larger than 600 square feet (55.75 m^2).
2. In coastal high-hazard areas and coastal A Zones, the floors of detached garages and detached accessory storage structures are permitted below the elevations specified in ASCE 24, provided that such structures are used solely for parking or storage, are one story and are not larger than 100 square feet (9.29 m^2). Such structures shall not be required to have breakaway walls or flood openings.

G112.2 Fences. Fences in floodways that have the potential to block the passage of floodwaters, such as stockade fences and wire mesh fences, shall meet the requirement of Section G104.5.

G112.3 Oil derricks. Oil derricks located in flood hazard areas shall be designed in conformance with the flood loads in Sections 1603.1.7 and 1612.

G112.4 Retaining walls, sidewalks and driveways. Retaining walls, sidewalks and driveways shall meet the requirements of Section 1804.5.

G112.5 Swimming pools. Swimming pools shall be designed and constructed in accordance with ASCE 24. Above-ground swimming pools, on-ground swimming pools and in-ground swimming pools that involve placement of fill in floodways shall also meet the requirements of Section G104.5.

G112.6 Decks, porches, and patios. Decks, porches and patios shall be designed and constructed in accordance with ASCE 24.

G112.7 Nonstructural concrete slabs in coastal high-hazard areas and coastal A zones. In coastal high-hazard areas and coastal A zones, nonstructural concrete slabs used as parking pads, enclosure floors, landings, decks, walkways, patios and similar nonstructural uses are permitted beneath or adjacent to buildings and structures provided that the concrete slabs shall be constructed in accordance with ASCE 24.

G112.8 Roads and watercourse crossings in regulated floodways. Roads and watercourse crossings that encroach into regulated floodways, including roads, bridges, culverts, low-water crossings and similar means for vehicles or pedestrians to travel from one side of a watercourse to the other, shall meet the requirement of Section G104.5.

SECTION G113—TEMPORARY STRUCTURES AND TEMPORARY STORAGE

G113.1 Temporary structures. Temporary structures shall be erected for a period of less than 180 days. Temporary structures shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design flood. Fully enclosed temporary structures shall have flood openings that are in accordance with ASCE 24 to allow for the automatic entry and exit of floodwaters.

G113.2 Temporary storage. Temporary storage includes storage of goods and materials for a period of less than 180 days. Stored materials shall not include hazardous materials.

G113.3 Floodway encroachment. Temporary structures and temporary storage in floodways shall meet the requirements of G104.5.

SECTION G114—UTILITY AND MISCELLANEOUS GROUP U

G114.1 Utility and miscellaneous Group U. Utility and miscellaneous Group U includes buildings that are accessory in character and miscellaneous structures not classified in any specific occupancy in this code, including, but not limited to, agricultural buildings, aircraft hangars (accessory to a one- or two-family residence), barns, carports, fences more than 6 feet (1829 mm) high, grain silos (accessory to a residential occupancy), greenhouses, livestock shelters, private garages, retaining walls, sheds, stables and towers.

G114.2 Flood loads. Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be anchored to prevent flotation, collapse or lateral movement resulting from flood loads, including the effects of buoyancy, during conditions of the design flood.

G114.3 Elevation. Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be elevated such that the lowest floor, including basement, is elevated to or above the design flood elevation in accordance with Section 1612 of this code.

G114.4 Enclosures below design flood elevation. Fully enclosed areas below the design flood elevation shall be constructed in accordance with ASCE 24.

G114.5 Flood-damage-resistant materials. Flood-damage-resistant materials shall be used below the design flood elevation.

G114.6 Protection of mechanical, plumbing and electrical systems. Mechanical, plumbing and electrical systems, including plumbing fixtures, shall be elevated to or above the design flood elevation.

Exception: Electrical systems, equipment and components; heating, ventilating, air conditioning and plumbing appliances; plumbing fixtures, duct systems and other service equipment shall be permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to

resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction requirements of this code. Electrical wiring systems shall be permitted to be located below the design flood elevation provided that they conform to the provisions of *the California Electrical Code.*

SECTION G115—REFERENCED STANDARDS

G115.1 General. See Table G115.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix referenced in the standard.

TABLE G115.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASCE 24—14	*Flood Resistant Design and Construction*	G104.1, G108.3, G108.4, G111.1, G112.1, G112.5, G112.6, G112.7, G113.1, G114.4
HUD 24 CFR Part 3285 (2008)	*Manufactured Home Construction and Safety Standards*	G102
CBC—*25*	*California Building Code*	G103.2, G114.1, G114.3
CRC—*25*	*California Residential Code*	G109.2, G109.4, G109.5
CEC—*25*	*California Electrical Code*	G109.4, G114.6

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX H – SIGNS

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

H

SIGNS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix H gathers in one place the various standards that regulate the construction and protection of outdoor signs. Wherever possible, the appendix provides standards in performance language, thus allowing the widest possible application.

ICC code development note: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION H101—GENERAL

H101.1 General. A sign shall not be erected in a manner that would confuse or obstruct the view of or interfere with exit signs required by Chapter 10 or with official traffic signs, signals or devices. Signs and sign support structures, together with their supports, braces, guys and anchors, shall be kept in repair and in proper state of preservation. The display surfaces of signs shall be kept neatly painted or posted at all times.

H101.2 Signs exempt from permits. The following signs are exempt from the requirements to obtain a permit before erection:

1. Painted nonilluminated signs.
2. Temporary signs announcing the sale or rent of property.
3. Signs erected by transportation authorities.
4. Projecting signs not exceeding 2.5 square feet (0.23 m^2).
5. The changing of moveable parts of an approved sign that is designed for such changes, or the repainting or repositioning of display matter shall not be deemed an alteration.

SECTION H102—DEFINITIONS

H102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

COMBINATION SIGN. A sign incorporating any combination of the features of pole, projecting and roof signs.

DISPLAY SIGN. The area made available by the sign structure for the purpose of displaying the advertising message.

ELECTRIC SIGN. A sign containing electrical wiring, but not including signs illuminated by an exterior light source.

GROUND SIGN. A billboard or similar type of sign that is supported by one or more uprights, poles or braces in or upon the ground other than a combination sign or pole sign, as defined by this code.

POLE SIGN. A sign wholly supported by a sign structure in the ground.

PORTABLE DISPLAY SURFACE. A display surface temporarily fixed to a standardized advertising structure that is regularly moved from structure to structure at periodic intervals.

PROJECTING SIGN. A sign other than a wall sign that projects from and is supported by a wall of a building or structure.

ROOF SIGN. A sign erected on or above a roof or parapet of a building or structure.

SIGN. Any letter, figure, character, mark, plane, point, marquee sign, design, poster, pictorial, picture, stroke, stripe, line, trademark, reading matter or illuminated service, which shall be constructed, placed, attached, painted, erected, fastened or manufactured in any manner whatsoever, so that the same shall be used for the attraction of the public to any place, subject, person, firm, corporation, public performance, article, machine or merchandise, whatsoever, which is displayed in any manner outdoors. Every sign shall be classified and conform to the requirements of that classification as set forth in this chapter.

SIGN STRUCTURE. Any structure that supports or is capable of supporting a sign as defined in this code. A sign structure is permitted to be a single pole and is not required to be an integral part of the building.

WALL SIGN. Any sign attached to or erected against the wall of a building or structure, with the exposed face of the sign in a plane parallel to the plane of said wall.

SECTION H103—LOCATION

H103.1 Location restrictions. Signs shall not be erected, constructed or maintained so as to obstruct any fire escape or any window or door or opening used as a means of egress or so as to prevent free passage from one part of a roof to any other part thereof. A sign shall not be attached in any form, shape or manner to a fire escape, nor be placed in such manner as to interfere with any opening required for ventilation.

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SECTION H104—IDENTIFICATION

H104.1 Identification. Every outdoor advertising display sign hereafter erected, constructed or maintained, for which a permit is required, shall be plainly marked with the name of the person, firm or corporation erecting and maintaining such sign and shall have affixed on the front thereof the permit number issued for said sign or other method of identification approved by the building official.

SECTION H105—DESIGN AND CONSTRUCTION

H105.1 General requirements. Signs shall be designed and constructed to comply with the provisions of this code for use of materials, loads and stresses.

H105.2 Permits, drawings and specifications. Where a permit is required, as provided in Chapter 1, construction documents shall be required. These documents shall show the dimensions, material and required details of construction, including loads, stresses and anchors.

H105.3 Wind load. Signs shall be designed and constructed to withstand wind pressure as provided for in Chapter 16.

H105.4 Seismic load. Signs designed to withstand wind pressures shall be considered capable of withstanding earthquake loads, except as provided for in Chapter 16.

H105.5 Working stresses. In outdoor advertising display signs, the allowable working stresses shall conform to the requirements of Chapter 16. The working stresses of wire rope and its fastenings shall not exceed 25 percent of the ultimate strength of the rope or fasteners.

Exceptions:

1. The allowable working stresses for steel and wood shall be in accordance with the provisions of Chapters 22 and 23.
2. The working strength of chains, cables, guys or steel rods shall not exceed one-fifth of the ultimate strength of such chains, cables, guys or steel.

H105.6 Attachment. Signs attached to masonry, concrete or steel shall be safely and securely fastened by means of metal anchors, bolts or approved expansion screws of sufficient size and anchorage to safely support the loads applied.

SECTION H106—ELECTRICAL

H106.1 Illumination. A sign shall not be illuminated by other than electrical means, and electrical devices and wiring shall be installed in accordance with the requirements of *the California Electrical Code.* Any open spark or flame shall not be used for display purposes unless specifically approved.

H106.1.1 Internally illuminated signs. Except as provided for in Section 2611, where internally illuminated signs have facings of wood or of approved plastic complying with the requirements of Section 2606.4, the area of such facing section shall be not more than 120 square feet (11.16 m^2) and the wiring for electric lighting shall be entirely enclosed in the sign cabinet with a clearance of not less than 2 inches (51 mm) from the facing material. The dimensional limitation of 120 square feet (11.16 m^2) shall not apply to sign facing sections made from flame-resistant-coated fabric (ordinarily known as "flexible sign face plastic") that weighs less than 20 ounces per square yard (678 g/m^2) and that, when tested in accordance with NFPA 701, meets the fire propagation performance requirements of both Test 1 and Test 2 or that, when tested in accordance with an approved test method, exhibits an average burn time of 2 seconds or less and a burning extent of 5.9 inches (150 mm) or less for 10 specimens.

H106.2 Electrical service. Signs that require electrical service shall comply with NFPA 70.

SECTION H107—COMBUSTIBLE MATERIALS

H107.1 Use of combustibles. Wood, plastics complying with the requirements of Section H107.1.1 or plastic *veneer* panels as provided for in Chapter 26, or other materials of combustible characteristics similar to wood, used for moldings, cappings, nailing blocks, letters and latticing, shall comply with Section H109.1 and shall not be used for other ornamental features of signs, unless approved.

H107.1.1 Plastic materials. Notwithstanding any other provisions of this code, plastics that burn at a rate not faster than 2.5 inches per minute (64 mm/s) when tested in accordance with ASTM D635 shall be approved for use as the display surface material and for the letters, decorations and facings on signs and outdoor display structures.

H107.1.2 Electric sign faces. Individual plastic facings of electric signs shall not exceed 200 square feet (18.6 m^2) in area.

H107.1.3 Area limitation. If the area of a display surface exceeds 200 square feet (18.6 m^2), the area occupied or covered by plastics complying with the requirements of Section H107.1.1 shall be limited to 200 square feet (18.6 m^2) plus 50 percent of the difference between 200 square feet (18.6 m^2) and the area of display surface. The area of plastic on a display surface shall not in any case exceed 1,100 square feet (102 m^2).

H107.1.4 Plastic appurtenances. Letters and decorations mounted on a plastic facing or display surface can be made of plastics complying with the requirements of Section H107.1.1.

SECTION H108—ANIMATED DEVICES

H108.1 Fail-safe device. Signs that contain moving sections or ornaments shall have fail-safe provisions to prevent the section or ornament from releasing and falling or shifting its center of gravity more than 15 inches (381 mm). The fail-safe device shall be in

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addition to the mechanism and the mechanism's housing that operate the movable section or ornament. The fail-safe device shall be capable of supporting the full dead weight of the section or ornament when the moving mechanism releases.

SECTION H109—GROUND SIGNS

H109.1 Height restrictions. The structural frame of ground signs shall not be erected of combustible materials to a height of more than 35 feet (10 668 mm) above the ground. Ground signs constructed entirely of noncombustible material shall not be erected to a height of greater than 100 feet (30 480 mm) above the ground. Greater heights are permitted where approved and located so as not to create a hazard or danger to the public.

H109.2 Required clearance. The bottom coping of every ground sign shall be not less than 3 feet (914 mm) above the ground or street level, which space can be filled with platform decorative trim or light wooden construction.

H109.3 Wood anchors and supports. Where wood anchors or supports are embedded in the soil, the wood shall be pressure treated with an approved preservative.

SECTION H110—ROOF SIGNS

H110.1 General. Roof signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in Sections H106.1.1 and H107.1. Provisions shall be made for electric grounding of metallic parts. Where combustible materials are permitted in letters or other ornamental features, wiring and tubing shall be kept free and insulated therefrom. Roof signs shall be so constructed as to leave a clear space of not less than 6 feet (1829 mm) between the roof level and the lowest part of the sign and shall have not less than 5 feet (1524 mm) clearance between the vertical supports thereof. Roof sign structures shall not project beyond an exterior wall.

Exception: Signs on flat roofs with every part of the roof accessible.

H110.2 Bearing plates. The bearing plates of roof signs shall distribute the load directly to or on masonry walls, steel roof girders, columns or beams. The building shall be designed to avoid overstress of these members.

H110.3 Height of solid signs. A roof sign having a solid surface shall not exceed, at any point, a height of 24 feet (7315 mm) measured from the roof surface.

H110.4 Height of open signs. Open roof signs in which the uniform open area is not less than 40 percent of total gross area shall not exceed a height of 75 feet (22 860 mm) on buildings of Type 1 or Type 2 construction. On buildings of other construction types, the height shall not exceed 40 feet (12 192 mm). Such signs shall be thoroughly secured to the building on which they are installed, erected or constructed by iron, metal anchors, bolts, supports, chains, stranded cables, steel rods or braces and they shall be maintained in good condition.

H110.5 Height of closed signs. A closed roof sign shall not be erected to a height greater than 50 feet (15 240 mm) above the roof of buildings of Type 1 or 2 construction or more than 35 feet (10 668 mm) above the roof of buildings of Type 3, 4 or 5 construction.

SECTION H111—WALL SIGNS

H111.1 Materials. Wall signs that have an area exceeding 40 square feet (3.72 m^2) shall be constructed of metal or other approved noncombustible material, except for nailing rails and as provided for in Sections H106.1.1 and H107.1.

H111.2 Exterior wall mounting details. Wall signs attached to exterior walls of solid masonry, concrete or stone shall be safely and securely attached by means of metal anchors, bolts or expansion screws of not less than $^3/_8$ inch (9.5 mm) diameter and shall be embedded not less than 5 inches (127 mm). Wood blocks shall not be used for anchorage, except in the case of wall signs attached to buildings with walls of wood. A wall sign shall not be supported by anchorages secured to an unbraced parapet wall.

H111.3 Extension. Wall signs shall not extend above the top of the wall or beyond the ends of the wall to which the signs are attached unless such signs conform to the requirements for roof signs, projecting signs or ground signs.

SECTION H112—PROJECTING SIGNS

H112.1 General. Projecting signs shall be constructed entirely of metal or other noncombustible material and securely attached to a building or structure by metal supports such as bolts, anchors, supports, chains, guys or steel rods. Staples or nails shall not be used to secure any projecting sign to any building or structure. The dead load of projecting signs not parallel to the building or structure and the load due to wind pressure shall be supported with chains, guys or steel rods having net cross-sectional dimension of not less than $^3/_8$ inch (9.5 mm) diameter. Such supports shall be erected or maintained at an angle of not less than 45 percent (0.78 rad) with the horizontal to resist the dead load and at angle of 45 percent (0.78 rad) or more with the face of the sign to resist the specified wind pressure. If such projecting sign exceeds 30 square feet (2.8 m^2) in one facial area, there shall be provided not fewer than two such supports on each side not more than 8 feet (2438 mm) apart to resist the wind pressure.

H112.2 Attachment of supports. Supports shall be secured to a bolt or expansion screw that will develop the strength of the supporting chains, guys or steel rods, with a minimum $^5/_8$-inch (15.9 mm) bolt or lag screw, by an expansion shield. Turnbuckles shall be placed in chains, guys or steel rods supporting projecting signs.

H112.3 Wall mounting details. Chains, cables, guys or steel rods used to support the live or dead load of projecting signs are permitted to be fastened to solid masonry walls with expansion bolts or by machine screws in iron supports, but such supports shall not be attached to an unbraced parapet wall. Where the supports must be fastened to walls made of wood, the supporting anchor bolts must go through the wall and be plated or fastened on the inside in a secure manner.

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H112.4 Height limitation. A projecting sign shall not be erected on the wall of any building so as to project above the roof or cornice wall or, on buildings without a cornice wall, above the roof level except that a sign erected at a right angle to the building, the horizontal width of which sign is perpendicular to such a wall and does not exceed 18 inches (457 mm), is permitted to be erected to a height not exceeding 2 feet (610 mm) above the roof or cornice wall or above the roof level where there is no cornice wall. A sign attached to a corner of a building and parallel to the vertical line of such corner shall be deemed to be erected at a right angle to the building wall.

H112.5 Additional loads. Projecting sign structures that will be used to support an individual on a ladder or other servicing device, whether or not specifically designed for the servicing device, shall be capable of supporting the anticipated additional load, but not less than a 100-pound (445 N) concentrated horizontal load and a 300-pound (1334 N) concentrated vertical load applied at the point of assumed or most eccentric loading. The building component to which the projecting sign is attached shall be designed to support the additional loads.

SECTION H113—MARQUEE SIGNS

H113.1 Materials. Marquee signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in Sections H106.1.1 and H107.1.

H113.2 Attachment. Marquee signs shall be attached to approved marquees that are constructed in accordance with Section 3106.

H113.3 Dimensions. Marquee signs, whether on the front or side, shall not project beyond the perimeter of the marquee.

H113.4 Height limitation. Marquee signs shall not extend more than 6 feet (1829 mm) above, or 1 foot (305 mm) below such marquee. Signs shall not have a vertical dimension greater than 8 feet (2438 mm).

SECTION H114—PORTABLE SIGNS

H114.1 General. Portable signs shall conform to requirements for ground, roof, projecting, flat and temporary signs where such signs are used in a similar capacity. The requirements of this section shall not be construed to require portable signs to have connections to surfaces, tie-downs or foundations where provisions are made by temporary means or configuration of the structure to provide stability for the expected duration of the installation.

SECTION H115—THICKNESS OF SIGNS

H115.1 General. Tables H115.1(1) and H115.1(2) provide requirements for the size, thicknesses and types of glass panels and projection signs, respectively.

TABLE H115.1(1)—SIZE, THICKNESS AND TYPE OF GLASS PANELS IN SIGNS

MAXIMUM SIZE OF EXPOSED PANEL		MINIMUM THICKNESS OF GLASS (inches)	TYPE OF GLASS
Any dimension (inches)	Area (square inches)		
30	500	$^1/_8$	Plain, plate or wired
45	700	$^3/_{16}$	Plain, plate or wired
144	3,600	$^1/_4$	Plain, plate or wired
> 144	> 3,600	$^1/_4$	Wired glass

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.

TABLE H115.1(2)—THICKNESS OF PROJECTION SIGN

PROJECTION (feet)	MAXIMUM THICKNESS (feet)
5	2
4	2.5
3	3
2	3.5
1	4

For SI: 1 foot = 304.8 mm.

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SECTION H116—REFERENCED STANDARDS

H116.1 General. See Table H116.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE H116.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM D635—18	*Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position*	H107.1.1
CEC—*25*	*California Electrical Code*	H106.1, H106.2
NFPA 701—23	*Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*	H106.1.1

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX I – PATIO COVERS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter				X																				
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below			X																					
Chapter / Section																								
I101			X																					
I102			X																					
I103			X																					

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APPENDIX

PATIO COVERS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix:	Appendix I provides standards applicable to the construction and use of patio covers. It is limited in application to patio covers accessory to dwelling units. Covers of patios and other outdoor areas associated with restaurants, mercantile buildings, offices, nursing homes or other nondwelling occupancies would be subject to standards in the main code and not this appendix.
ICC code development note:	Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION I101—GENERAL

I101.1 General. Patio covers shall be permitted to be detached from or attached to dwelling units. Patio covers shall be used only for recreational, outdoor living purposes and not as carports, garages, storage rooms or habitable rooms.

SECTION I102—DEFINITION

I102.1 General. The following term shall, for the purposes of this appendix, have the meaning shown herein. Refer to Chapter 2 of this code for general definitions.

PATIO COVER. A structure with open or glazed walls that is used for recreational, outdoor living purposes associated with a dwelling unit.

SECTION I103—EXTERIOR WALLS AND OPENINGS

I103.1 Enclosure walls. Enclosure walls shall be permitted to be of any configuration, provided that the open or glazed area of the longer wall and one additional wall is equal to not less than 65 percent of the area below not less than 6 feet 8 inches (2032 mm) of each wall, measured from the floor. Openings shall be permitted to be enclosed with insect screening, translucent or transparent plastic conforming to the provisions of Sections 2606 through 2610, glass conforming to the provisions of Chapter 24 or any combination of the foregoing.

I103.2 Light, ventilation and emergency egress. Exterior openings of the dwelling unit required for light and ventilation shall be permitted to open into a patio structure. However, the patio structure shall be unenclosed if such openings are serving as emergency egress or rescue openings from sleeping rooms. Where such exterior openings serve as an exit from the dwelling unit, the patio structure, unless unenclosed, shall be provided with exits conforming to the provisions of Chapter 10.

SECTION I104—HEIGHT

I104.1 Height. Patio covers shall be limited to one-story structures not more than 12 feet (3657 mm) in height.

SECTION I105—STRUCTURAL PROVISIONS

I105.1 Design loads. Patio covers shall be designed and constructed to sustain, within the stress limits of this code, all dead loads plus a minimum vertical live load of 10 pounds per square foot (0.48 kN/m^2) except that snow loads shall be used where such snow loads exceed this minimum. Such patio covers shall be designed to resist the minimum wind and seismic loads set forth in this code.

I105.2 Footings. In areas with a frost depth of zero, a patio cover shall be permitted to be supported on a concrete slab on grade without footings, provided that the slab conforms to the provisions of Chapter 19 and is not less than $3^1/_2$ inches (89 mm) thick, and the columns do not support loads in excess of 750 pounds (3.34 kN) per column.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX J – GRADING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)				**X**	**X**																			
Adopt only those sections that are listed below																								
Chapter / Section																								
J104.1				X	X																			
J105.1				X	X																			

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APPENDIX

J GRADING

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix J provides standards for the grading of properties. The appendix also provides standards for the administration and enforcement of a grading program, including permit and inspection requirements. Appendix J was originally developed in the 1960s and used for many years in jurisdictions throughout the western United States. It is intended to provide consistent and uniform code requirements anywhere grading is considered an issue.

ICC code development note: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION J101—GENERAL

J101.1 Scope. The provisions of this chapter apply to grading, excavation and earthwork construction, including fills and embankments. Where conflicts occur between the technical requirements of this chapter and the geotechnical report, the geotechnical report shall govern.

J101.2 Flood hazard areas. Unless the applicant has submitted an engineering analysis, prepared in accordance with standard engineering practice by a registered design professional, that demonstrates the proposed work will not result in any increase in the level of the base flood, grading, excavation and earthwork construction, including fills and embankments, shall not be permitted in floodways that are in flood hazard areas established in Section 1612.3 or in flood hazard areas where design flood elevations are specified but floodways have not been designated.

SECTION J102—DEFINITIONS

J102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

BENCH. A relatively level step excavated into earth material on which fill is to be placed.

COMPACTION. The densification of a fill by mechanical means.

CUT. See "Excavation."

DOWN DRAIN. A device for collecting water from a swale or ditch located on or above a slope, and safely delivering it to an approved drainage facility.

EROSION. The wearing away of the ground surface as a result of the movement of wind, water or ice.

EXCAVATION. The removal of earth material by artificial means, also referred to as a cut.

FILL. Deposition of earth materials by artificial means.

GRADE. The vertical location of the ground surface.

GRADE, EXISTING. The grade prior to grading.

GRADE, FINISHED. The grade of the site at the conclusion of all grading efforts.

GRADING. An excavation or fill or combination thereof.

KEY. A compacted fill placed in a trench excavated in earth material beneath the toe of a slope.

SLOPE. An inclined surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance.

TERRACE. A relatively level step constructed in the face of a graded slope for drainage and maintenance purposes.

SECTION J103—PERMITS REQUIRED

J103.1 Permits required. Except as exempted in Section J103.2, grading shall not be performed without first having obtained a permit therefor from the building official. A grading permit does not include the construction of retaining walls or other structures.

J103.2 Exemptions. A grading permit shall not be required for the following:

1. Grading in an isolated, self-contained area, provided that the public is not endangered and that such grading will not adversely affect adjoining properties.
2. Excavation for construction of a structure permitted under this code.
3. Cemetery graves.
4. Refuse disposal sites controlled by other regulations.
5. Excavations for wells, or trenches for utilities.

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6. Mining, quarrying, excavating, processing or stock-piling rock, sand, gravel, aggregate or clay controlled by other regulations, provided that such operations do not affect the lateral support of, or significantly increase stresses in, soil on adjoining properties.
7. Exploratory excavations performed under the direction of a registered design professional.

Exemption from the permit requirements of this appendix shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction.

SECTION J104—PERMIT APPLICATION AND SUBMITTALS

J104.1 Submittal requirements. In addition to the provisions of Section 105.3 *and 1.8.4, as applicable,* the applicant shall state the estimated quantities of excavation and fill.

J104.2 Site plan requirements. In addition to the provisions of Section 107, a grading plan shall show the existing grade and finished grade in contour intervals of sufficient clarity to indicate the nature and extent of the work and show in detail that it complies with the requirements of this code. The plans shall show the existing grade on adjoining properties in sufficient detail to identify how grade changes will conform to the requirements of this code.

J104.3 Geotechnical report. A geotechnical report prepared by a registered design professional shall be provided. The report shall contain not less than the following:

1. The nature and distribution of existing soils.
2. Conclusions and recommendations for grading procedures.
3. Soil design criteria for any structures or embankments required to accomplish the proposed grading.
4. Where necessary, slope stability studies, and recommendations and conclusions regarding site geology.

Exception: A geotechnical report is not required where the building official determines that the nature of the work applied for is such that a report is not necessary.

J104.4 Liquefaction study. For sites with maximum considered earthquake spectral response accelerations at short periods (S_s) greater than 0.5g as determined by Chapter 11 of ASCE 7, a study of the liquefaction potential of the site shall be provided and the recommendations incorporated in the plans.

Exception: A liquefaction study is not required where the building official determines from established local data that the liquefaction potential is low.

SECTION J105—INSPECTIONS

J105.1 General. Inspections shall be governed by Section 110, *Chapter 1, Division II.*

J105.2 Special inspections. The special inspection requirements of Section 1705.6 shall apply to work performed under a grading permit where required by the building official.

SECTION J106—EXCAVATIONS

J106.1 Maximum slope. The slope of cut surfaces shall be not steeper than is safe for the intended use, and shall be not more than one unit vertical in two units horizontal (50-percent slope) unless the owner or the owner's authorized agent furnishes a geotechnical report justifying a steeper slope.

Exceptions:

1. A cut surface shall be permitted to be at a slope of 1.5 units horizontal to 1 unit vertical (67-percent slope) provided that all of the following are met:
   1.1. It is not intended to support structures or surcharges.
   1.2. It is adequately protected against erosion.
   1.3. It is not more than 8 feet (2438 mm) in height.
   1.4. It is approved by the building code official.
   1.5. Ground water is not encountered.
2. A cut surface in bedrock shall be permitted to be at a slope of 1 unit horizontal to 1 unit vertical (100-percent slope).

SECTION J107—FILLS

J107.1 General. Unless otherwise recommended in the geotechnical report, fills shall comply with the provisions of this section.

J107.2 Surface preparation. The ground surface shall be prepared to receive fill by removing vegetation, topsoil and other unsuitable materials, and scarifying the ground to provide a bond with the fill material.

J107.3 Benching. Where existing grade is at a slope steeper than one unit vertical in five units horizontal (20-percent slope) and the depth of the fill exceeds 5 feet (1524 mm) benching shall be provided in accordance with Figure J107.3. A key shall be provided that is not less than 10 feet (3048 mm) in width and 2 feet (610 mm) in depth.

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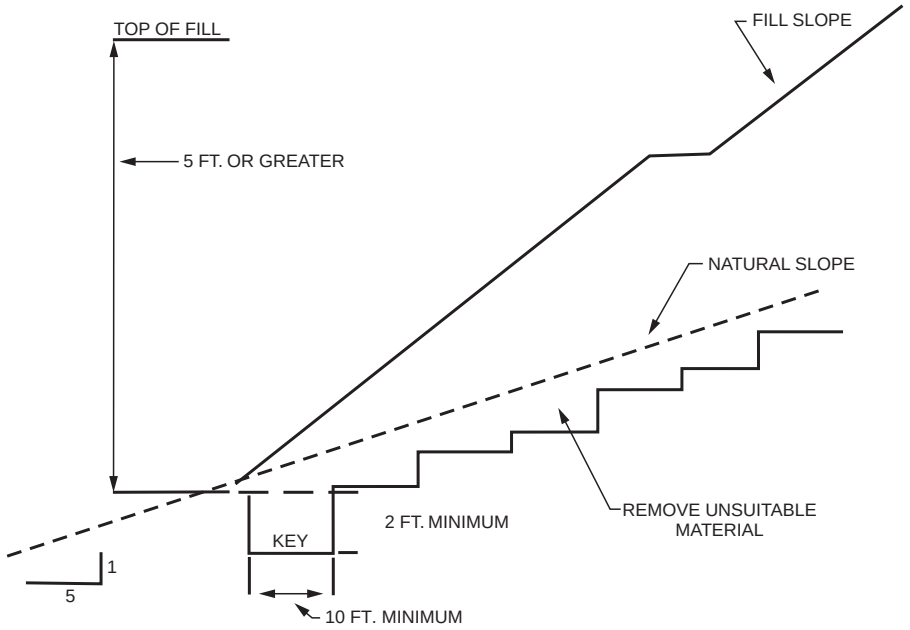
FIGURE J107.3—BENCHING DETAILS



For SI: 1 foot = 304.8 mm.

J107.4 Fill material. Fill material shall not include organic, frozen or other deleterious materials. Rock or similar irreducible material greater than 12 inches (305 mm) in any dimension shall not be included in fills.

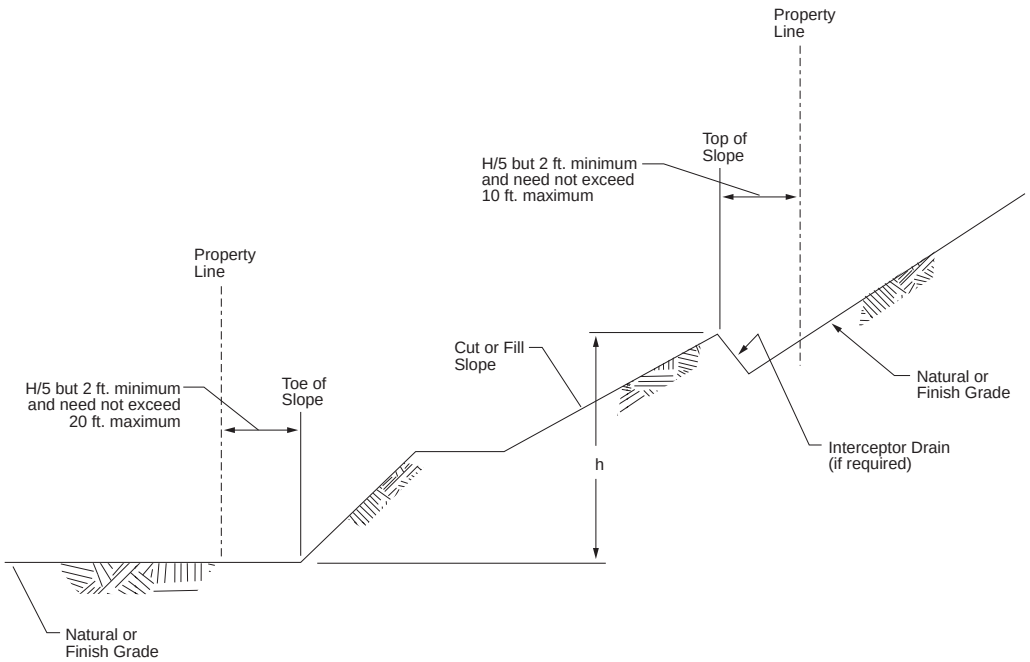
J107.5 Compaction. All fill material shall be compacted to 90 percent of maximum density as determined by ASTM D1557, Modified Proctor, in lifts not exceeding 12 inches (305 mm) in depth.

J107.6 Maximum slope. The slope of fill surfaces shall be not steeper than is safe for the intended use. Fill slopes steeper than one unit vertical in two units horizontal (50-percent slope) shall be justified by a geotechnical report or engineering data.

SECTION J108—SETBACKS

J108.1 General. Cut and fill slopes shall be set back from the property lines in accordance with this section. Setback dimensions shall be measured perpendicular to the property line and shall be as shown in Figure J108.1, unless substantiating data is submitted justifying reduced setbacks.

FIGURE J108.1—DRAINAGE DIMENSIONS


Property Line
Top of Slope
H/5 but 2 ft. minimum and need not exceed 10 ft. maximum
Property Line
Cut or Fill Slope
H/5 but 2 ft. minimum and need not exceed 20 ft. maximum
Toe of Slope
Natural or Finish Grade
Interceptor Drain (if required)
h
Natural or Finish Grade

For SI: 1 foot = 304.8 mm.

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J108.2 Top of slope. The setback at the top of a cut slope shall be not less than that shown in Figure J108.1, or than is required to accommodate any required interceptor drains, whichever is greater.

J108.3 Slope protection. Where required to protect adjacent properties at the toe of a slope from adverse effects of the grading, additional protection, approved by the building official, shall be included. Examples of such protection include but are not be limited to:

1. Setbacks greater than those required by Figure J108.1.
2. Provisions for retaining walls or similar construction.
3. Erosion protection of the fill slopes.
4. Provision for the control of surface waters.

SECTION J109—DRAINAGE AND TERRACING

J109.1 General. Unless otherwise recommended by a registered design professional, drainage facilities and terracing shall be provided in accordance with the requirements of this section.

Exception: Drainage facilities and terracing need not be provided where the ground slope is not steeper than one unit vertical in three units horizontal (33-percent slope).

J109.2 Terraces. Terraces not less than 6 feet (1829 mm) in width shall be established at not more than 30-foot (9144 mm) vertical intervals on all cut or fill slopes to control surface drainage and debris. Suitable access shall be provided to allow for cleaning and maintenance.

Where more than two terraces are required, one terrace, located at approximately mid-height, shall be not less than 12 feet (3658 mm) in width.

Swales or ditches shall be provided on terraces. They shall have a minimum gradient of one unit vertical in 20 units horizontal (5-percent slope) and shall be paved with concrete not less than 3 inches (76 mm) in thickness, or with other materials suitable to the application. They shall have a depth not less than 12 inches (305 mm) and a width not less than 5 feet (1524 mm).

A single run of swale or ditch shall not collect runoff from a tributary area exceeding 13,500 square feet (1256 m^2) (projected) without discharging into a down drain.

J109.3 Interceptor drains. Interceptor drains shall be installed along the top of cut slopes receiving drainage from a tributary width greater than 40 feet (12 192 mm), measured horizontally. They shall have a minimum depth of 1 foot (305 mm) and a minimum width of 3 feet (915 mm). The slope shall be approved by the building official, but shall be not less than one unit vertical in 50 units horizontal (2-percent slope). The drain shall be paved with concrete not less than 3 inches (76 mm) in thickness, or by other materials suitable to the application. Discharge from the drain shall be accomplished in a manner to prevent erosion and shall be approved by the building official.

J109.4 Drainage across property lines. Drainage across property lines shall not exceed that which existed prior to grading. Excess or concentrated drainage shall be contained on site or directed to an approved drainage facility. Erosion of the ground in the area of discharge shall be prevented by installation of nonerosive down drains or other devices.

SECTION J110—EROSION CONTROL

J110.1 General. The faces of cut and fill slopes shall be prepared and maintained to control erosion. This control shall be permitted to consist of effective planting.

Exception: Erosion control measures need not be provided on cut slopes not subject to erosion due to the erosion-resistant character of the materials.

Erosion control for the slopes shall be installed as soon as practicable and prior to calling for final inspection.

J110.2 Other devices. Where necessary, check dams, cribbing, riprap or other devices or methods shall be employed to control erosion and provide safety.

SECTION J111—REFERENCED STANDARDS

J111.1 General. See Table J111.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE J111.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM D1557—12(2021)	*Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort* [56,000 ft-lbf/ft^3(2,700 kN-m/m^3)].	J107.5
ASCE/SEI 7—22	*Minimum Design Loads and Associated Criteria for Buildings and Other Structures*	J104.4

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX K – GROUP R-3 AND GROUP R-3.1 OCCUPANCIES PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																				X				
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

K

GROUP R-3 AND GROUP R-3.1 OCCUPANCIES PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

SECTION K101—SCOPE

K101.1 General. *The provisions of this section shall apply to new construction, changes of use and to substantial improvement and restoration of substantial damage as defined in Section 1612, of Group R-3 and R-3.1 Occupancies in areas protected by the facilities of the Central Valley Flood Protection Plan where flood levels are anticipated to exceed three feet for the 200-year flood event. Except as specifically required by this section, buildings and structures shall meet applicable provisions of this code.*

Exception: *Changes of use of Group R-3 to Group R-3.1 Occupancies, including any substantial improvement done under the same permit.*

K101.1.1 Construction documents. *If the land on which the proposed work is to be constructed is located in an area protected by the facilities of the Central Valley Flood Protection Plan, the construction documents shall include the WSEL200 and the elevation(s) of the floor(s), and, as applicable, the elevation(s) and slopes of roofs, of the building or structure.*

SECTION K102—DEFINITIONS

K102.1 General. *The following words and terms shall, for the purposes of this section, have the meanings shown.*

AREAS PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN WHERE FLOOD LEVELS ARE ANTICIPATED TO EXCEED THREE FEET FOR THE 200-YEAR FLOOD EVENT. Geographical areas identified by the state as "Areas Protected by the Facilities of the Central Valley Flood Protection Plan where Flood Levels are Anticipated to Exceed Three Feet for the 200-Year Flood Event" in accordance with Health and Safety Code Section 50465. Published data from the California Department of Water Resources can be obtained online at the following website: www.water.ca.gov/ BuildingCodes.

Note: *The facilities of the Central Valley Flood Protection Plan are identified in the following counties: Butte, Colusa, Fresno, Glenn, Lake, Madera, Merced, Plumas, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Tehama, Yolo and Yuba. Determination of additional facilities is ongoing.*

CENTRAL VALLEY. *Any lands in the bed or along or near the banks of the Sacramento River and the San Joaquin River, and any of their tributaries or connected therewith, or upon any land adjacent thereto, or within any of the overflow basins thereof, or upon any land susceptible to overflow therefrom. The following counties and the incorporated municipalities within these counties, in whole or in part, are in the Central Valley: Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Benito, San Joaquin, Shasta, Sierra, Siskiyou, Solano, Stanislaus, Sutter, Tehama, Tuolumne, Yolo and Yuba. A map that delineates the Central Valley can be obtained online at the following website: www.water.ca.gov/BuildingCodes.*

EVACUATION LOCATION. *A location no less than one (1) foot (0.30 meter) above the WSEL200 where occupants are expected to congregate pending evacuation and from which occupants may be evacuated during conditions of flooding, such as a space within the building that has an exit door or operable window; a deck, balcony, porch, rooftop platform or rooftop area, or combinations thereof.*

FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN. *The facilities referenced herein include the facilities of State Plan of Flood Control and other flood management facilities in the Central Valley evaluated under the Central Valley Flood Protection Plan, which will be completed in 2012 and updated every 5 years thereafter. The facilities of State Plan of Flood Control include the state and federal flood control works (levees, weirs, channels and other features) of the Sacramento River Flood Control Project described in Water Code Section 8350, and flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Water Code section 12648) of Chapter 2 of Part 6 of Division 6 for which the Central Valley Flood Protection Board or the Department of Water Resources has provided the assurances of nonfederal cooperation to the United States, and those facilities identified in Water Code Section 8361.*

ROUTE TO THE EVACUATION LOCATION. *The path through and along which occupants move from the habitable areas of a building or structure that are below the WSEL200 to the evacuation location.*

WSEL200. *The water surface elevation (WSEL) of the 200-year flood event that is identified by the state when it identifies areas that receive protection from the facilities of the Central Valley Flood Protection Plan.*

SECTION K103—STRUCTURAL STABILITY

K103.1 General. *Portions of buildings and structures supporting evacuation locations shall be designed, constructed, connected and anchored to resist flotation, collapse or permanent lateral movement resulting from the hydrostatic loads anticipated during conditions of flooding anticipated for the 200-year flood event.*

K103.2 Determination of loads. *Hydrostatic loads, based on the depth of water determined by the WSEL200, shall be determined in accordance with Chapter 5 of ASCE 7. Reduction of hydrostatic loads may be accomplished by allowing for the automatic entry and exit*

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of floodwaters to minimize unbalanced loads. Such means shall be designed by a registered design professional and include, but are not limited to, openings, valves and panels designed to yield under load.

Exception: *When two flood vents are installed on opposite sides of the building or structure, one on each side, that comply with Figure K103.1.*

SECTION K104—EVACUATION LOCATIONS

K104.1 General. *An evacuation location and a route to the evacuation location shall be provided for Group R-3 and R-3.1 Occupancies.*

K104.2 Route to evacuation location. *A route shall be allowed through any number of intervening rooms or spaces. Doors along the route shall be openable without the use of a key or lock, special knowledge or effort.*

Exception: *Doors in individual dwelling or sleeping units having an occupant load of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.*

K104.2.1 Group R-3.1 Occupancies. *The route to an evacuation location shall meet the accessibility requirements of Chapter 11A or 11B as applicable.*

K104.3 Minimum size requirements. *Evacuation locations shall provide a minimum gross floor area of 7 square feet (0.65 m2) per occupant, based on the occupant load of the portions of the building that are below the WSEL200. The area provided shall be adequate to accommodate the occupant load of the upper levels as well as the anticipated occupant load from the area below the WSEL200.*

SECTION K105—SPACE WITHIN THE BUILDING

K105.1 General. *If the evacuation location is a space within a building, the evacuation location shall be provided with a means for occupants to be evacuated out of the building specified in Sections K105.1.1, K105.1.2 or K105.1.3.*

K105.1.1 Windows, minimum size and dimensions. *A minimum of one window shall be provided that meets the minimum size, minimum dimensions and operational constraints of Section 1026. The number of such windows shall be appropriate for the occupancy or occupancies of the portions of the building that are below the WSEL200.*

Note: *It is the intent of this section that windows are of sufficient number, sizes and dimensions to reasonably accommodate the needs and limitations of the occupants of the building. Reasonable judgment in the application of this requirement must be exercised by the building official.*

K105.1.2 Exterior doors to decks, balconies and porches. *Exterior doors to decks, balconies and porches shall be sized in accordance with Section 1008.*

Exception: *In Group R-3.1 Occupancies that are subject to the requirements of Chapters 11A or 11B, doors to decks, balconies or porches shall comply with Section 1132A.1.*

K105.1.3 Means of escape to rooftops from spaces within a building. *The means of escape to rooftops shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.*

Exception: *In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such accessibility requirements shall apply to the means of escape to rooftops.*

SECTION K106—DECKS AND BALCONIES THAT ARE EVACUATION LOCATIONS

K106.1 General. *Decks and balconies that have finish floors no less than one (1) foot (0.30 meter) above the WSEL200 shall be permitted to be evacuation locations. When a deck or balcony used as an evacuation location is not at the same level as a floor within the building, it shall be permitted to be accessed by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.*

K106.2 Live load. *Decks and balconies that are evacuation locations shall be designed for the live load required for the occupancy as required in Table 1607.2.*

K106.3 Evacuation route. *Evacuation routes to decks and balconies that are evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.*

Exception: *In Group R-3.1 Occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to decks and balconies.*

SECTION K107—ROOFTOP EVACUATION LOCATIONS

K107.1 General. *Rooftop evacuation locations shall be permitted to include rooftop platforms and rooftop areas provided that they are no less than one (1) foot (0.30 meter) above the WSEL200. A minimum horizontal distance of three (3) feet (0.91 meter) shall be provided between the lower edge of the rooftop evacuation location access point and the evacuation location lower perimeter.*

K107.2 Rooftop platforms required. *A rooftop platform shall be provided if the roof covering materials are:*

1. *Clay tile, concrete tile, slate shingles, wood shingles or wood shakes, and the roof slope is three units vertical in 12 units horizontal (25 percent slope) or greater.*

2. *Metal roof panels or metal roof shingles, and the roof slope is one unit vertical in 12 units horizontal (8.33 percent slope) or greater.*

K107.3 Roof live loads. *Roof areas that are rooftop evacuation locations and roofs that support rooftop platforms that are evacuation locations shall be designed for the roof live load required for the occupancy as required in Table 1607.2.*

K107.4 Evacuation routes to rooftop evacuation locations. *Evacuation routes to rooftop evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.*

Exception: *In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to rooftops.*

K107.5 Perimeter protection. *For Group R-3 and R-3.1 occupancies, the perimeter of rooftop evacuation locations shall be protected by:*

1. *Guards per Section 1013 if a rooftop platform is provided; or*
2. *A railing that is 12 inches (305 mm) in height if a sloped roof is provided.*

K107.6 Utility/equipment buffer zone. *A separation of 48 inches shall be provided between a rooftop evacuation location and any mechanical equipment, photovoltaic system, utility service drop or other utility line. Electrical service lines shall not pass over evacuation locations.*

SECTION K108—ATTICS THAT ARE EVACUATION LOCATIONS

K108.1 General. *Attics that have finish floors no less than one (1) foot (0.30 meter) above the WSEL200 shall be permitted to be evacuation locations.*

K108.2 Headroom. *When an attic is used as an evacuation location, the minimum headroom of the required area shall be 30 inches (762 mm) with 50 percent of the required area having a headroom of 60 inches (1524 mm).*

K108.3 Attic flooring. *The required area of the evacuation location shall be solidly sheathed.*

K108.4 Attic live loads. *Attic areas that are used as evacuation locations shall be designed for the floor live load required for the occupancy as required in Table 1607.2.*

K108.5 Evacuation routes to attic evacuation locations. *Evacuation routes to attic evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.*

Exception: *In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to attics.*

K108.6 Means of escape from attics. *The means of escape from attics shall comply with Section K105.*

SECTION K109—ALTERNATE MEANS OF PROTECTION

K109.1 Request for approval of alternate means of protection. *Requests for approval to use an alternative means of protection shall be made in writing to the building official by the owner or the owner's authorized representative. The request shall be accompanied by a full statement of the conditions and sufficient evidence that the proposed alternate means of protection provides reasonable protection to occupants. The building official shall require the owner to obtain a written statement from the applicable emergency management authority regarding plans and processes related to notification of anticipated conditions of flooding, warnings, evacuations and other pertinent conditions relative to the proximity of nearby levees. The building official shall also require the owner to obtain a written statement and findings from the entity that has jurisdiction over the management, maintenance, monitoring and control of flood protection works in the vicinity of the location of the owner's property; such statement shall comment on the viability of the proposed alternate means of protection. The building official may request written statements from the Central Valley Flood Protection Board, the California Department of Water Resources, and the California Emergency Management Agency.*

Approval of a request for use of an alternative means of protection made pursuant to these provisions shall be limited to the particular case covered by the request and shall not be construed as establishing any precedent for any future request except in substantially equivalent situations.

Note: *Contact information for the California Department of Water Resources and the Department's Directory of Flood Officials, which includes levee and reclamation district boundary maps, is available on-line at the following web site: www.water.ca.gov/BuildingCodes. The Department of Water Resources Building Code Project Engineer can be contacted at 916-574-1451. The Central Valley Flood Control Board Chief Engineer can be contacted at 916- 574-0609. The California Emergency Management Agency Inland Region Program Manager can be contacted at 916-845-8488.*

K109.2 Appeals. *When a request for an alternate means of protection has been denied by the building official, the applicant may file a written appeal with the board of appeals. In considering such appeal, the board of appeals may provide additional information to, and request additional written statements from, the Central Valley Flood Protection Board, the California Department of Water Resources, and the California Emergency Management Agency. If such additional written statements are provided, the board of appeals shall consider those statements.*

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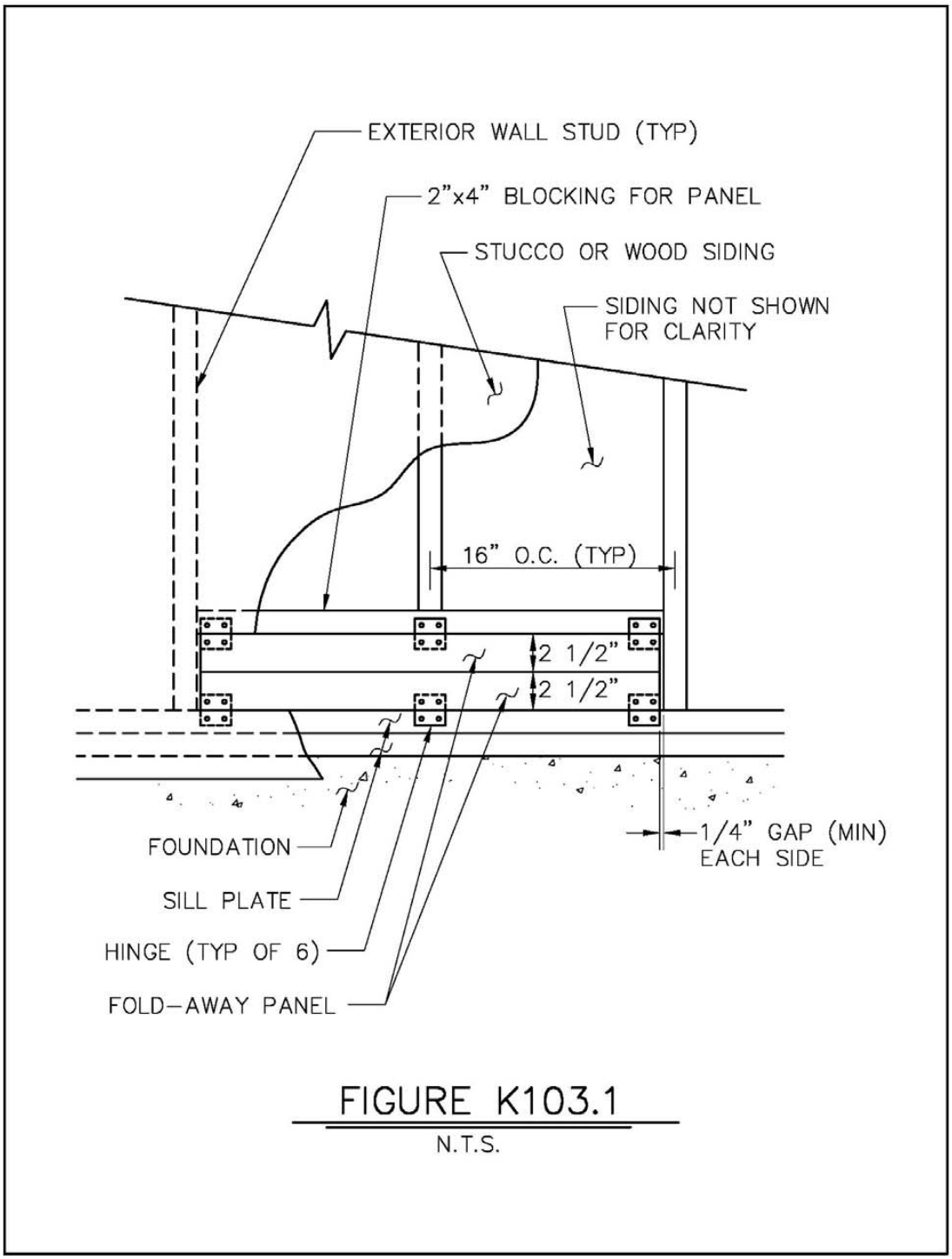

FIGURE K103.1
N.T.S.

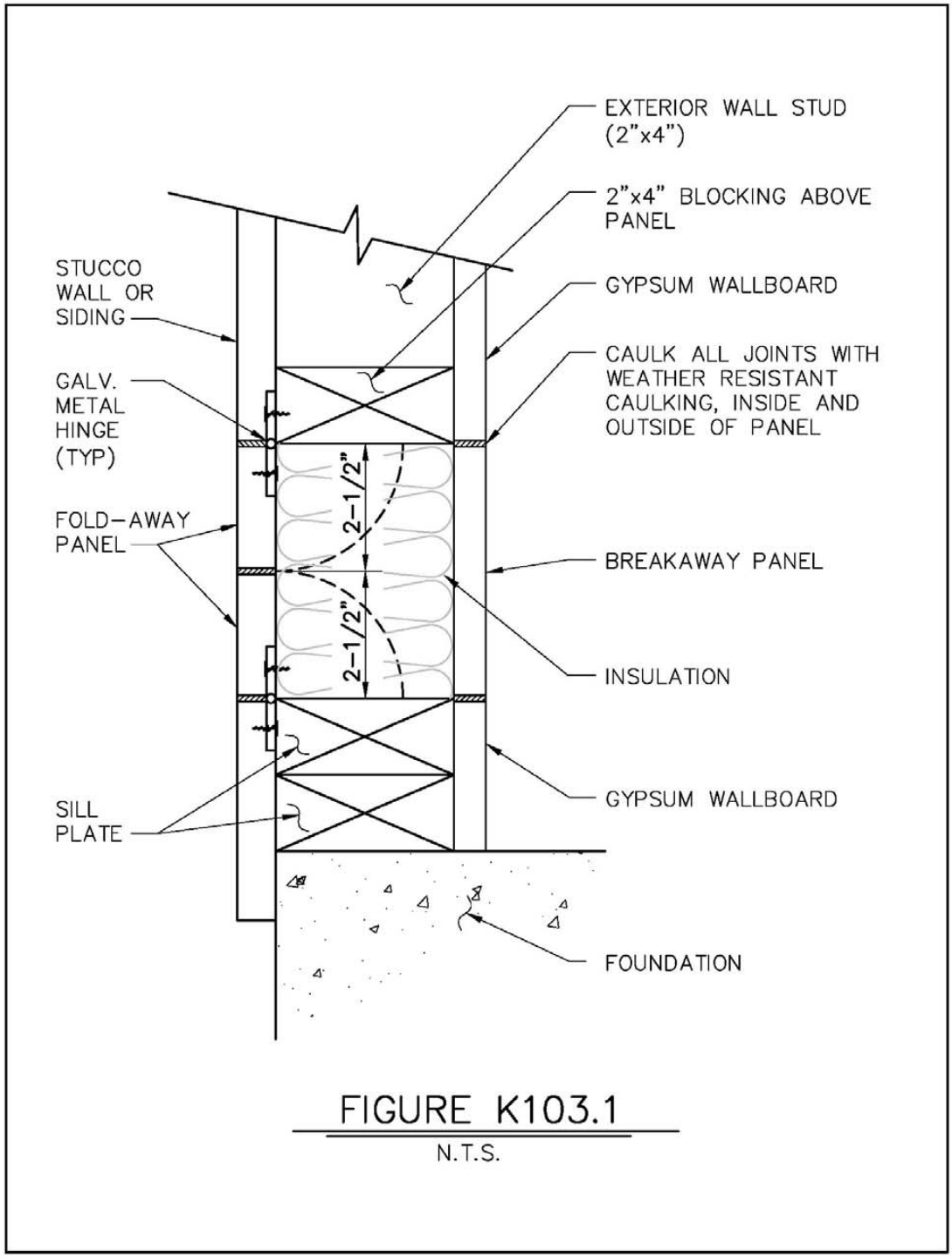

FIGURE K103.1
N.T.S.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX L – EARTHQUAKE RECORDING INSTRUMENTATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)										X				X										
Adopt only those sections that are listed below																								
Chapter / Section																								
L101.1										X				X										
L101.2										X				X										
L101.3										X														

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APPENDIX

L

EARTHQUAKE RECORDING INSTRUMENTATION

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: The purpose of Appendix L is to foster the collection of ground motion data, particularly from strong-motion earthquakes. When this ground motion data is synthesized, it may be useful in developing future improvements to the earthquake provisions of the code.

ICC code development note: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION L101—GENERAL

L101.1 General. Every structure located where the 1-second spectral response acceleration, S_1, determined in accordance with Chapter 11 of ASCE 7, is greater than 0.40 and either exceeds six stories in height with an aggregate floor area of 60,000 square feet (5574 m^2) or more, or exceeds 10 stories in height regardless of floor area, shall be equipped with not fewer than three approved recording accelerographs. The accelerographs shall be interconnected for common start and common timing.

[OSHPD 1 & 4] *There shall be a sufficient number of instruments to characterize the response of the building during an earthquake and shall include at least one tri-axial free field instrument or equivalent.*

L101.2 Location. As a minimum, instruments shall be located at the lowest level, mid-height, and near the top of the structure. Each instrument shall be located so that access is maintained at all times and is unobstructed by room contents. A sign stating "MAINTAIN CLEAR ACCESS TO THIS INSTRUMENT" in 1-inch (25 mm) block letters shall be posted in a conspicuous location.

[OSHPD 1 & 4] *A proposal for instrumentation and equipment specifications shall be forwarded to the enforcement agency for review and approval.*

L101.3 Maintenance. Maintenance and service of the instrumentation shall be provided by the owner of the structure. Data produced by the instrument shall be made available to the building official on request.

Maintenance and service of the instruments shall be performed annually by an approved testing agency. The owner shall file with the building official a written report from an approved testing agency certifying that each instrument has been serviced and is in proper working condition. This report shall be submitted when the instruments are installed and annually thereafter. Each instrument shall have affixed to it an externally visible tag specifying the date of the last maintenance or service and the printed name and address of the testing agency.

[OSHPD 1] *Data retrieval from the instrument and processing of the records shall be the responsibility of the enforcement agency.*

SECTION L102—REFERENCED STANDARDS

L102.1 General. See Table L102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE L102.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASCE/SEI 7—22	*Minimum Design Loads and Associated Criteria for Buildings and Other Structures*	L101.1

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX M – TSUNAMI-GENERATED FLOOD HAZARD

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

M

TSUNAMI-GENERATED FLOOD HAZARDS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix M allows the adoption of guidelines for constructing vertical evacuation refuge structures within areas that are considered tsunami hazard zones.

ICC code development note: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION M101—REFUGE STRUCTURES FOR VERTICAL EVACUATION FROM TSUNAMI-GENERATED FLOOD HAZARDS

M101.1 General. The purpose of this appendix is to provide tsunami vertical evacuation planning criteria for those coastal communities that have a tsunami hazard as shown in a *Tsunami Design Zone* Map.

M101.2 Definitions. The following term shall, for the purposes of this appendix, have the meaning shown herein. Refer to Chapter 2 of this code for general definitions.

TSUNAMI DESIGN ZONE MAP. A map that designates the extent of inundation by a Maximum Considered Tsunami, as defined by Chapter 6 of ASCE 7.

M101.3 Establishment of tsunami design zone. Where applicable, the *Tsunami Design Zone* Map shall meet or exceed the inundation limit given by the ASCE 7 *Tsunami Design Geodatabase*.

M101.4 Planning of tsunami vertical evacuation refuge structures within the tsunami design zone. Tsunami Vertical Evacuation *Refuge Structures* located within a tsunami hazard design zone shall be planned, sited, and developed in general accordance with the planning criteria of the FEMA P646 guidelines.

Exception: These criteria shall not be considered mandatory for evaluation of existing buildings for evacuation planning purposes.

SECTION M102—REFERENCED STANDARDS

M102.1 General. See Table M102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE M102.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASCE 7—22	*Minimum Design Load and Associated Criteria for Buildings and Other Structures*	M101.2, M101.3
FEMA P646—12	*Guidelines for Design of Structures for Vertical Evacuation from Tsunamis*	M101.4

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX N – REPLICABLE BUILDINGS

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

N

REPLICABLE BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix N provides jurisdictions with a means of incorporating guidelines for replicable buildings into their building code adoption process. The intent of these provisions is to give jurisdictions a means of streamlining their document review process while verifying code compliance.

ICC code development note: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION N101—ADMINISTRATION

N101.1 Purpose. The purpose of this appendix is to provide a format and direction regarding the implementation of a replicable building program.

N101.2 Objectives. Such programs allow a jurisdiction to recover from a natural disaster faster and allow for consistent application of the codes for replicable building projects. It will result in faster turnaround for the end user, and a quicker turnaround through the plan review process.

SECTION N102—DEFINITIONS

N102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein.

REPLICABLE BUILDING. A building or structure utilizing a replicable design.

REPLICABLE DESIGN. A prototypical design developed for application in multiple locations with minimal variation or modification.

SECTION N103—REPLICABLE DESIGN REQUIREMENTS

N103.1 Prototypical construction documents. A replicable design shall establish prototypical construction documents for application at multiple locations. The construction documents shall include details appropriate to each wind region, seismic design category and climate zone for locations in which the replicable design is intended for application. Application of replicable design shall not vary with regard to the following, except for allowable variations in accordance with Section N106:

1. Use and occupancy classification.
2. Building heights and area limitations.
3. Type of construction classification.
4. Fire-resistance ratings.
5. Interior finishes.
6. Fire protection system.
7. Means of egress.
8. Accessibility.
9. Structural design criteria.
10. Energy efficiency.
11. Type of mechanical and electrical systems.
12. Type of plumbing system and number of fixtures.

SECTION N104—REPLICABLE DESIGN SUBMITTAL REQUIREMENTS

N104.1 General. A summary description of the replicable design and related construction documents shall be submitted to an approved agency. Where approval is requested for elements of the replicable design that is not within the scope of the *California Building Code*, the construction documents shall specifically designate the codes for which review is sought. Construction documents shall be signed, sealed and dated by a registered design professional.

N104.1.1 Architectural plans and specifications. Where approval of the architectural requirements of the replicable design is sought, the submittal documents shall include architectural plans and specifications as follows:

1. Description of uses and the proposed occupancy groups for all portions of the building.
2. Proposed type of construction of the building.
3. Fully dimensioned drawings to determine building areas and height.
4. Adequate details and dimensions to evaluate means of egress, including occupant loads for each floor, exit arrangement and sizes, corridors, doors and stairs.

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5. Exit signs and means of egress lighting, including power supply.
6. Accessibility scoping provisions.
7. Description and details of proposed special occupancies such as a covered mall, high-rise, mezzanine, atrium and public garage.
8. Adequate details to evaluate fire-resistance-rated construction requirements, including data substantiating required ratings.
9. Details for plastics, insulation and safety glazing installation.
10. Details of required fire protection systems.
11. Material specifications demonstrating fire-resistance criteria.

N104.1.2 Structural plans, specifications and engineering details. Where approval of the structural requirements of the replicable design is sought, the submittal documents shall include details for each wind region, seismic design category and climate zone for which approval is sought; and shall include the following:

1. Signed and sealed structural design calculations that support the member sizes on the drawings.
2. Design load criteria, including: frost depth, live loads, snow loads, wind loads, earthquake design date and other special loads.
3. Details of foundations and superstructure.
4. Provisions for special inspections.

N104.1.3 Energy conservation details. Where approval of the energy conservation requirements of the replicable design is sought, the submittal documents shall include details for each climate zone for which approval is sought; and shall include the following:

1. Climate zones for which approval is sought.
2. Building envelope details.
3. Building mechanical system details.
4. Details of electrical power and lighting systems.
5. Provisions for system commissioning.

SECTION N105—REVIEW AND APPROVAL OF REPLICABLE DESIGN

N105.1 General. Proposed replicable designs shall be reviewed by an approved agency. The review shall be applicable only to the replicable design features submitted in accordance with Section N104. The review shall determine compliance with this code and additional codes specified in Section N104.1.

N105.2 Documentation. The results of the review shall be documented indicating compliance with the code requirements.

N105.3 Deficiencies. Where the review of the submitted construction documents identifies elements where the design is deficient and will not comply with the applicable code requirements, the approved agency shall notify the proponent of the replicable design, in writing, of the specific areas of noncompliance and request correction.

N105.4 Approval. Where the review of the submitted construction documents determines that the design is in compliance with the codes designated in Section N104.1, and where deficiencies identified in Section N105.3 have been corrected, the approved agency shall issue a summary report of Approved Replicable Design. The summary report shall include any limitations on the approved replicable design including, but not limited to, climate zones, wind regions and seismic design categories.

SECTION N106—SITE-SPECIFIC APPLICATION OF APPROVED REPLICABLE DESIGN

N106.1 General. Where site-specific application of a replicable design that has been approved under the provisions of Section N105 is sought, the construction documents submitted to the building official shall comply with this section.

N106.2 Submittal documents. A summary description of the replicable design and related construction document shall be submitted. Construction documents shall be signed, sealed and dated by the registered design professional. A statement, signed, sealed and dated by the registered design professional, that the replicable design submitted for local review is the same as the replicable design reviewed by the approved agency shall be submitted.

N106.2.1 Architectural plans and specifications. Architectural plans and specifications shall include the following:

1. Construction documents for variations from the replicable design.
2. Construction for portions that are not part of the replicable design.
3. Documents for local requirements as identified by the building official.
4. Construction documents detailing the foundation system.

SECTION N107—SITE-SPECIFIC REVIEW AND APPROVAL OF REPLICABLE DESIGN

N107.1 General. Proposed site-specific application of replicable design shall be submitted to the building official in accordance with the provisions of Chapter 1 and Appendix N.

N107.2 Site-specific review and approval of replicable design. The building official shall verify that the replicable design submitted for site-specific application is the same as the approved replicable design reviewed by the approved agency. In addition, the building official shall review the following for code compliance.

1. Construction documents for variations from the replicable design.
2. Construction for portions of the building that are not part of the replicable design.
3. Documents for local requirements as identified by the building official.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX O – PERFORMANCE-BASED APPLICATION

(Not adopted by state agencies)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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[A] APPENDIX

O PERFORMANCE-BASED APPLICATION

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix: Appendix O provides an optional design, review and approval framework for use by the building official. Typical uses would include cases of alternate methods in Chapter 1, select areas of the code that require a rational analysis such as Section 909 and elsewhere. It simply extracts the relevant administrative provisions from the *ICC Performance Code* into a more concise, usable appendix format for a jurisdiction confronted with such a need. Currently there are multiple, varying jurisdictional rules and procedures in many communities regarding procedure and none in even more. The building official is often left alone to reach decisions not just on the merits of a design but must first also decide on the submittal and review process. As an appendix, the provisions herein are entirely optional to a jurisdiction. This appendix can be adopted, adopted with local modifications, or even used on a case-by-case basis as part of a Memorandum of Understanding or similar legal agreement between the jurisdiction and the owner/design team. It simply represents another tool for the jurisdiction to reach for in cases of need; it neither encourages nor creates any additional opportunity for performance-based design.

ICC code development note: Code change proposals to this appendix will be considered by the Administrative Code Development Committee during the 2025 (Group B) Code Development Cycle.

[A] SECTION O101—GENERAL

O101.1 Introduction. The following administrative provisions are excerpted from the *International Code Council Performance Code for Buildings and Facilities* and can be used in conjunction with the Alternate Methods provisions in Chapter 1, or for a review of submittals requiring a rational analysis or performance-based design. These provisions provide an established framework for the building official in terms of the design expertise needed, the necessary submittals, a review framework and related items.

O101.2 Qualifications. Registered design professionals shall possess the knowledge, skills and abilities necessary to demonstrate compliance with this code.

O101.3 Construction document preparation. Construction documents required by this code shall be prepared in adequate detail and submitted for review and approval in accordance with Section 107.

O101.3.1 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions in accordance with Section 107.

O101.4 Construction. Construction shall comply with the approved construction documents submitted in accordance with this code, and shall be verified and approved to demonstrate compliance with this code.

O101.4.1 Facility operating policies and procedures. Policies, operations, training and procedures shall comply with approved documents submitted in accordance with this code, and shall be verified and approved to demonstrate compliance with this code.

O101.4.2 Maintenance. Maintenance of the performance-based design shall be ensured throughout the life of the building or portion thereof.

O101.4.3 Changes. The owner or the owner's authorized agent shall be responsible to ensure that any change to the facility, process or system does not increase the hazard level beyond that originally designed without approval and that changes shall be documented in accordance with the code.

O101.5 Documentation. The registered design professional shall prepare appropriate documentation for the project, clearly detailing the approach and rationale for the design submittal, the construction and the future use of the building, facility or process.

O101.5.1 Reports and manuals. The design report shall document the steps taken in the design analysis, clearly identifying the criteria, parameters, inputs, assumptions, sensitivities and limitations involved in the analysis. The design report shall clearly identify bounding conditions, assumptions and sensitivities that clarify the expected uses and limitations of the performance analysis. This report shall verify that the design approach is in compliance with the applicable codes and acceptable methods and shall be submitted for concurrence by the building official prior to the construction documents being completed. The report shall document the design features to be incorporated based on the analysis.

The design report shall address the following:

1. Project scope.
2. Goals and objectives.
3. Performance criteria.
4. Hazard scenarios.
5. Design fire loads and hazards.
6. Final design.
7. Evaluation.

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8. Bounding conditions and critical design assumptions.
9. Critical design features.
10. System design and operational requirements.
11. Operational and maintenance requirements.
12. Commissioning testing requirements and acceptance criteria.
13. Frequency of certificate renewal.
14. Supporting documents and references.
15. Preliminary site and floor plans.

O101.5.2 Design submittal. Applicable construction documents shall be submitted to the building official for review. The documents shall be submitted in accordance with the jurisdiction's procedures and in sufficient detail to obtain appropriate permits.

O101.6 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions.

O101.6.1 Peer review. The owner or the owner's authorized agent shall be responsible for retaining and furnishing the services of a registered design professional or recognized expert, who will perform as a peer reviewer, where required and approved by the building official.

O101.6.2 Costs. The costs of special services, including contract review, where required by the building official, shall be borne by the owner or the owner's authorized agent.

O101.7 Permits. Prior to the start of construction, appropriate permits shall be obtained in accordance with the jurisdiction's procedures and applicable codes.

O101.8 Verification of compliance. Upon completion of the project, documentation shall be prepared that verifies performance and prescriptive code provisions have been met. Where required by the building official, the registered design professional shall file a report that verifies bounding conditions are met.

O101.9 Extent of documentation. Approved construction documents, the operations and maintenance manual, inspection and testing records, and certificates of occupancy with conditions shall be included in the project documentation of the building official's records.

O101.10 Analysis of change. The registered design professional shall evaluate the existing building, facilities, premises, processes, and contents, and the applicable documentation of the proposed change as it affects portions of the building, facility, premises, processes and contents that were previously designed for compliance under a performance-based code. Prior to any change that was not documented in a previously approved design, the registered design professional shall examine the applicable design documents, bounding conditions, operation and maintenance manuals, and deed restrictions.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX P – SLEEPING LOFTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter																								
Adopt entire chapter as amended (amended sections listed below)				**X**	**X**																			
Adopt only those sections that are listed below																								
Chapter / Section																								
P105.1				X	X																			
P106 *Reserved*				X	X																			
Table P106 *Reserved*				X	X																			

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APPENDIX

P

SLEEPING LOFTS

The provisions contained in this appendix are not mandatory unless specifically *adopted by a state agency or* referenced in the adopting ordinance.

User notes:

About this appendix:	Appendix P provides allowances for, and limitations on, spaces intended to be used as sleeping lofts, while differentiating these spaces from mezzanines and other habitable space.
ICC code development note:	Code change proposals to sections in this appendix will be considered by the IBC—General Code Development Committee during the 2025 (Group B) Code Development Cycle.

SECTION P101—GENERAL

P101.1 General. Where provided in Group R occupancies, sleeping lofts shall comply with the provisions of this code, except as modified by this appendix. Sleeping lofts constructed in compliance with this appendix shall be considered a portion of the story below. Such sleeping lofts shall not contribute to either the building area or number of stories as regulated by Section 503.1. The sleeping loft floor area shall be included in determining the fire area.

The following sleeping lofts are exempt from compliance with this appendix:

1. Sleeping lofts with a maximum depth of less than 3 feet (914 mm).
2. Sleeping lofts with a floor area of less than 35 square feet (3.3 m²).
3. Sleeping lofts not provided with a permanent means of egress.

P101.2 Sleeping loft limitations. Sleeping lofts shall comply with the following:

1. The sleeping loft floor area shall be less than 70 square feet (6.5 m^2).
2. The sleeping loft ceiling height shall not exceed 7 feet (2134 mm) for more than one-half of the sleeping loft floor area.

The provisions of this appendix shall not apply to sleeping lofts that do not comply with Items 1 and 2.

P101.3 Sleeping loft ceiling height. The clear height below the sleeping loft floor construction shall be not less than 7 feet (2134 mm). The ceiling height above the finished floor of the sleeping loft shall be not less than 3 feet (914 mm). Portions of the sleeping loft with a sloped ceiling measuring less than 3 feet (914 mm) from the finished floor to the finished ceiling shall not contribute to the sleeping loft floor area.

P101.4 Sleeping loft area. The aggregate area of all sleeping lofts and mezzanines within a room shall comply with Section 505.2.1.

Exception: The area of a single sleeping loft shall not be greater than two-thirds of the area of the room in which it is located, provided that no other sleeping lofts or mezzanines are open to the room in which the sleeping loft is located.

SECTION P102—DEFINITIONS

P102.1 General. The following term shall, for the purposes of this appendix, have the meaning shown herein. Refer to Chapter 2 for general definitions.

SLEEPING LOFT. A space on an intermediate level or levels between the floor and ceiling of a Group R occupancy dwelling or sleeping unit, open on one or more sides to the room in which the sleeping loft is located.

SECTION P103—MEANS OF EGRESS

P103.1 General. Where a permanent means of egress is provided for sleeping lofts, the means of egress shall comply with Chapter 10 of this code, as modified by Sections P103.2 through P103.6.

P103.2 Ceiling height at sleeping loft means of egress. A minimum ceiling height of 3 feet (914 mm) shall be provided for the entire width of the means of egress from the sleeping loft.

P103.3 Stairways. Stairways providing egress from sleeping lofts shall be permitted to comply with Sections P103.3.1 through P103.3.3.

P103.3.1 Width. Stairways providing egress from a sleeping loft shall not be less than 17 inches (432 mm) in clear width at or above the handrail. The width below the handrail shall be not less than 20 inches (508 mm).

P103.3.2 Treads and risers. Risers for stairs providing egress from a sleeping loft shall be not less than 7 inches (178 mm) and not more than 12 inches (305 mm) in height. Tread depth and riser height shall be calculated in accordance with one of the following formulas:

1. The tread depth shall be 20 inches (508 mm) minus four-thirds of the riser height.
2. The riser height shall be 15 inches (381 mm) minus three-fourths of the tread depth.

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P103.3.3 Landings. Landings at stairways providing egress from sleeping lofts shall comply with Section 1011.6, except that the depth of landings in the direction of travel shall be not less than 24 inches (508 mm).

P103.4 Alternating tread devices. Alternating tread devices shall be permitted as a means of egress from sleeping lofts, where the sleeping loft floor is not more than 10 feet (3048 mm) above the floor of the room to which it is open. Handrails and treads of such alternating tread devices shall comply with Section 1011.14.

P103.5 Ship's ladders. Ship's ladders shall be permitted as a means of egress from sleeping lofts where the sleeping loft floor is not more than 10 feet (3048 mm) above the floor of the room to which it is open. Handrails and treads of such ship's ladders shall comply with Section 1011.15.

P103.6 Ladders. Ladders shall be permitted as a means of egress from sleeping lofts where the sleeping loft floor is not more than 10 feet (3048 mm) above the floor of the room to which it is open. Such ladders shall comply with Sections P103.6.1 and P103.6.2.

P103.6.1 Size and capacity. Ladders providing egress from sleeping lofts shall have a rung width of not less than 12 inches (305 mm), and 10-inch (254 mm) to 14-inch (356 mm) spacing between rungs. Ladders shall be capable of supporting a 300-pound (136 kg) load on any rung. Rung spacing shall be uniform within $^{3}/_{8}$ inch (9.5 mm).

P103.6.2 Incline. Ladders shall be inclined at 70 to 80 degrees from horizontal.

SECTION P104—GUARDS

P104.1 General. Guards complying with Section 1015 shall be provided at the open sides of sleeping lofts.

Exception: The guard height at sleeping lofts shall be permitted to be 36 inches (914 mm) where the ceiling height of the sleeping loft is 42 inches (1067 mm) or less.

SECTION P105—SMOKE ALARMS

P105.1 General Listed single- or multiple-station smoke alarms complying with *Section 907.2.11* shall be installed in all sleeping lofts.

SECTION P106—*RESERVED*

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX Q – EMERGENCY HOUSING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD							BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5	6								
Adopt entire chapter				X	X																			
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

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APPENDIX

Q EMERGENCY HOUSING

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION Q101—GENERAL

Q101.1 Scope. *This appendix shall be applicable to emergency housing and emergency housing facilities, as defined in Section Q102.*

SECTION Q102—DEFINITIONS

Q102.1 General. *The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.*

DECLARATION OF SHELTER CRISIS. *The duly proclaimed existence of a situation in which a significant number of persons are without the ability to obtain shelter, resulting in a threat to their health and safety. (See Government Code Section 8698.)*

DEPENDENT UNIT. *Emergency housing not equipped with a kitchen area, toilet and sewage disposal system. Recreational vehicles that are not self-contained and without utility service connections shall be considered dependent units.*

EMERGENCY HOUSING. *Housing in a permanent or temporary structure(s), occupied during a declaration of state of emergency, local emergency or shelter crisis. Emergency housing may include, but is not limited to, buildings and structures constructed in accordance with the California Building Standards Code; and emergency sleeping cabins, emergency transportable housing units and tents constructed in accordance with this appendix.*

EMERGENCY HOUSING FACILITIES. *On-site common use facilities supporting emergency housing. Emergency housing facilities include, but are not limited to, kitchen areas, toilets, showers and bathrooms with running water. The use of emergency housing facilities is limited exclusively to the occupants of the emergency housing, personnel involved in operating the housing and other emergency personnel.*

EMERGENCY HOUSING SITE. *A site containing emergency housing and emergency housing facilities supporting the emergency housing.*

EMERGENCY SLEEPING CABIN*. Relocatable hard-sided structure constructed in accordance with this appendix, which may be occupied only for emergency housing if allowed by the enforcing agency.*

EMERGENCY TRANSPORTABLE HOUSING UNIT. *A single- or multiple-section prefabricated structure that is transportable by a vehicle and that can be installed on a permanent or temporary site in response to a need for emergency housing. Emergency transportable housing units include, but are not limited to, manufactured homes, mobilehomes, multifamily manufactured homes, recreational vehicles and park trailers. For the purposes of this appendix, emergency transportable housing units may also include commercial modulars as defined in the Health and Safety Code Section 18001.8, if approved by the enforcing agency.*

Emergency transportable housing units do not include factory-built housing as defined in the Health and Safety Code Section 19971.

LANDING PLATFORM. *A landing provided as the top step of a stairway accessing a loft.*

LOCAL EMERGENCY. *Local Emergency as defined in the Government Code, Section 8558.*

LOFT. *A floor level located more than 30 inches (762 mm) above the main floor and open to it on at least one side with a ceiling height of less than 6 feet 8 inches (2032 mm), used as a living or sleeping space.*

MANUFACTURED HOME. *A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18007.*

MEMBRANE STRUCTURE. *An air-inflated, air-supported, cable or frame-covered structure, not otherwise defined as a tent. (See Chapter 31 of this code.)*

MOBILEHOME. *A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18008.*

MULTIFAMILY MANUFACTURED HOME. *A structure designed to contain not less than two dwelling units, as defined in the Health and Safety Code, Section 18008.7.*

PARK TRAILER. *A trailer designed for human habitation that meets all requirements in the Health and Safety Code, Section 18009.3.*

RECREATIONAL VEHICLE. *A motor home, travel trailer, truck camper or camping trailer, with or without motive power, designed for human habitation, that meets all requirements in the Health and Safety Code, Section 18010.*

STATE OF EMERGENCY. *State of Emergency as defined in the Government Code, Section 8558.*

TENT. *A structure, enclosure or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported by any manner except by air or the contents that it protects.*

SECTION Q103—EMERGENCY HOUSING

Q103.1 General. *Emergency sleeping cabins, emergency transportable housing units, membrane structures and tents constructed and/or assembled in accordance with this appendix, shall be occupied only during declaration of state of emergency, local emergency or shelter crisis.*

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Buildings and structures constructed in accordance with the California Building Standards Code, used as emergency housing, shall be permitted to be permanently occupied.

Q103.2 Existing buildings. *Existing residential and nonresidential buildings or structures shall be permitted to be used as emergency housing and emergency housing facilities provided such buildings or structures comply with the building code provisions and/or other regulations in effect at the time of original construction and/or alteration. Existing buildings or structures used as emergency housing shall not become or continue to be substandard buildings, as determined by the enforcing agency.*

Q103.2.1 New additions, alterations and change of occupancy. *New additions, alterations and change of occupancy to existing buildings shall comply with the requirements of the California Building Standards Code effective at the time of addition, alteration or change of occupancy. The requirements shall apply only to and/or within the specific area of the addition, alteration or change of occupancy.*

Exception: *Existing buildings and structures used for emergency housing and emergency housing facilities may not be required to comply with the California Energy Code, as determined by the enforcing agency.*

Q103.3 Occupant load. *Except as otherwise stated in this appendix, the maximum occupant load allowed in buildings and structures used as emergency housing shall be determined by the enforcing agency, but the interior floor area shall not be less than 70 square feet (6.5 m^2) for one occupant. Where more than one person occupies the building/structure, the required floor area shall be increased at the rate of 50 square feet (4.65 m^2) for each occupant in excess of one.*

Exceptions:

1. *Tents.*
2. *Recreational vehicles and park trailers designed for human habitation that meet the requirements in the Health and Safety Code, Sections 18009.3 and 18010, as applicable.*
3. *For emergency housing, including emergency sleeping cabins, the minimum interior floor area may be reduced to 53 square feet (4.9 m^2) if the enforcing agency determines that 53 square feet (4.9 m^2) is adequate space for a single-occupancy sleeping unit.*

Q103.4 Fire and life safety requirements not addressed in this appendix. *If not otherwise addressed in this appendix, fire and life safety measures, including, but not limited to, means of egress, fire separation, fire sprinklers, smoke alarms and carbon monoxide alarms, shall be determined and enforced by the enforcing agency.*

Q103.5 Privacy. *Emergency housing shall be provided with a privacy lock on each entrance door and all windows for use by the occupants.*

Q103.6 Heating. *All sleeping areas shall be provided with adequate heating as determined by the enforcing agency.*

SECTION Q104—EMERGENCY SLEEPING CABINS

Q104.1 General. *Emergency sleeping cabins shall have an interior floor area of not less than 70 square feet (6.5 m^2) for one occupant. Where more than one person occupies the cabin, the required floor area shall be increased at the rate of 50 square feet (4.65 m^2) for each occupant in excess of one. The interior floor area shall not exceed 400 square feet (37 m^2), excluding lofts.*

Q104.2 Live loads. *Emergency sleeping cabins shall be designed to resist intrusion of wind, rain, and to support the following live loads:*

1. *Floor live loads not less than 40 pounds per square foot (1.92 kPa) of floor area.*
2. *Horizontal live loads not less than 15 pounds per square foot (718 Pa) of vertical wall and roof area.*
3. *Roof live loads not less than 20 pounds per square foot (958 Pa) of horizontal roof area.*
4. *In areas where snow loads are greater than 20 pounds per square foot (958 Pa), the roof shall be designed and constructed to resist these additional loads.*

Q104.3 Minimum ceiling height. *Habitable space and hallways in emergency sleeping cabins shall have a ceiling height of not less than 80 inches (2032 mm). Bathrooms, toilet rooms and kitchens, if provided, shall have a ceiling height of not less than 76 inches (1930 mm). Obstructions shall not extend below these minimum ceiling heights including beams, girders, ducts, lighting and other obstructions.*

Exception: *Ceiling heights in lofts constructed in accordance with Section Q108 are permitted to be less than 80 inches (2032 mm).*

Q104.4 Means of egress. *Emergency sleeping cabins shall be provided with at least two forms of egress placed remotely from each other. One form of egress may be an egress window complying with Section Q104.4.1. When a loft is provided, one form of egress shall be an egress window complying with Section Q104.4.1, provided in the loft space.*

Q104.4.1 Egress window. *The bottom of the clear opening of the egress window shall not be more than 44 inches (1118 mm) above the floor. The egress window shall have a minimum net clear opening height of 24 inches (610 mm), and a minimum net clear opening width of 20 inches (508 mm). The egress window shall have a minimum net clear opening area of 5 square feet (0.465 m^2).*

Q104.5 Plumbing and gas service. *If an emergency sleeping cabin contains plumbing or gas service, it shall comply with all applicable requirements of the California Plumbing Code and the California Mechanical Code.*

Q104.6 Electrical. *Emergency sleeping cabins shall be provided with all of the following installed in compliance with the California Electrical Code:*

1. *Continuous source of electricity.*

   Exception: *The source of electricity may be an emergency generator or renewable source of power such as solar or wind power.*

2. *At least one interior lighting fixture.*
3. *Electrical heating equipment listed for residential use and a dedicated receptacle outlet for the electrical heating equipment.*

   Exception: *Electrical heating equipment and a dedicated receptacle outlet for the electrical heating equipment are not required if a nonelectrical source of heating is provided.*
4. *At least one GFCI-protected receptacle outlet for use by the occupant(s).*

Q104.7 Ventilation. *Emergency sleeping cabins shall be provided with means of ventilation (natural and/or mechanical) allowing for adequate air replacement, as determined by the enforcing agency.*

Q104.8 Smoke alarms. *Emergency sleeping cabins shall be provided with at least one smoke alarm installed in accordance with the California Residential Code, Section R314.*

Q104.9 Carbon monoxide alarms. *If an emergency sleeping cabin contains a fuel-burning appliance(s) or a fireplace(s), a carbon monoxide alarm shall be installed in accordance with the California Residential Code, Section R315.*

SECTION Q105—EMERGENCY TRANSPORTABLE HOUSING UNITS

Q105.1 General. *In addition to the requirements in this appendix, manufactured homes, mobilehomes, multifamily manufactured homes, commercial modulars, recreational vehicles and park trailers used as emergency transportable housing shall comply with all applicable requirements in the Health and Safety Code, Division 13, Part 2; and Title 25, Division 1, Chapter 3, Subchapter 2.*

SECTION Q106—TENTS AND MEMBRANE STRUCTURES

Q106.1 General. *Tents shall not be used to house occupants for more than 7 days unless such tents are maintained with tight wooden floors raised at least 4 inches (101.6 mm) above the ground level and are equipped with baseboards on all sides to a height of at least 6 inches (152.4 mm). Tents may be maintained with concrete slabs with the finished surface at least 4 inches (101.6 mm) above grade and equipped with curbs on all sides at least 6 inches (152.4 mm) high.*

A tent shall not be considered a suitable sleeping place when it is found necessary to provide heating facilities in order to maintain a minimum temperature of 50 degrees Fahrenheit (10 degrees Celsius) within such tent during the period of occupancy.

Membrane structures installed and/or assembled in accordance with Chapter 31 of this code, may be permitted to be used as emergency housing and emergency housing facilities, as determined by the enforcing agency.

SECTION Q107—ACCESSIBILITY

Q107.1 General. *Emergency housing shall comply with the applicable requirements in Chapter 11B and/or the US Access Board Final Guidelines for Emergency Transportable Housing.*

Note: *The Architectural and Transportation Barriers Compliance Board (US Access Board) issued the Final Guidelines for Emergency Transportable Housing on May 7, 2014. The final guidelines amended the 2004 ADA Accessibility Guidelines (2004 ADAAG) and the 2004 Architectural Barriers Act (ABA) Accessibility Guidelines (2004 ABAAG) to specifically address emergency transportable housing units provided to disaster survivors by entities subject to the ADA or ABA. The final rule ensures that the emergency transportable housing units are readily accessible to and usable by disaster survivors with disabilities.*

SECTION Q108—LOFTS IN EMERGENCY HOUSING

Q108.1 Minimum loft area and dimensions. *Lofts used as a sleeping or living space shall meet the minimum area and dimension requirements of Sections Q108.1.1 through Q108.1.3.*

Q108.1.1 Minimum area. *Lofts shall have a floor area of not less than 35 square feet (3.25 m^2).*

Q108.1.2 Minimum dimensions. *Lofts shall be not less than 5 feet (1524 mm) in any horizontal dimension.*

Q108.1.3 Height effect on loft area. *Portions of a loft with a sloping ceiling measuring less than 3 feet (914 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft.*

Exception*: Under gable roofs with a minimum slope of 6:12, portions of a loft with a sloping ceiling measuring less than 16 inches (406 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft.*

Q108.2 Loft access. *The access to and primary egress from lofts shall be any type described in Sections Q108.2.1 through Q108.2.4.*

Q108.2.1 Stairways. *Stairways accessing lofts shall comply with the California Residential Code or with Sections Q108.2.1.1 through Q108.2.1.6.*

Q108.2.1.1 Width. *Stairways accessing a loft shall not be less than 17 inches (432 mm) in clear width at or above the handrail. The minimum width below the handrail shall be not less than 20 inches (508 mm).*

Q108.2.1.2 Headroom. *The headroom in stairways accessing a loft shall be not less than 74 inches (1880 mm), as measured vertically, from a sloped line connecting the tread or landing platform nosings in the middle of their width.*

Q108.2.1.3 Treads and risers. *Risers for stairs accessing a loft shall be not less than 7 inches (178 mm) and not more than 12 inches (305 mm) in height. Tread depth and riser height shall be calculated in accordance with one of the following formulas:*

1. *The tread depth shall be 20 inches (508 mm) minus 4/3 of the riser height, or*

2. *The riser height shall be 15 inches (381 mm) minus 3/4 of the tread depth.*

Q108.2.1.4 Landing platforms. *The top step of stairways accessing lofts shall be constructed as a landing platform where the loft ceiling height is less than 74 inches (1880 mm). The landing platform shall be 18 inches (457 mm) to 22 inches (559 mm) in depth measured from the nosing of the landing platform to the edge of the loft, and 16 inches (406 mm) to 18 inches (457 mm) in height measured from the landing platform to the loft floor.*

Q108.2.1.5 Handrails. *Handrails shall comply with the California Residential Code, Section R311.7.8.*

Q108.2.1.6 Stairway guards. *Guards at open sides of stairways shall comply with the California Residential Code, Section R312.1.*

Q108.2.2 Ladders. *Ladders accessing lofts shall comply with Sections Q108.2.2.1 and Q108.2.2.2.*

Q108.2.2.1 Size and capacity. *Ladders accessing lofts shall have a rung width of not less than 12 inches (305 mm), and 10 inches (254 mm) to 14 inches (356 mm) spacing between rungs. Ladders shall be capable of supporting a 200 pound (90.7 kg) load on any rung. Rung spacing shall be uniform within $^{3}/_{8}$ inch (9.5 mm).*

Q108.2.2.2 Incline. *Ladders shall be installed at 70 to 80 degrees from horizontal.*

Q108.2.3 Alternating tread devices. *Alternating tread devices are acceptable as allowed by the enforcing agency.*

Q108.2.4 Loft guards. *Loft guards shall be located along the open side of lofts. Loft guards shall not be less than 36 inches (914 mm) in height or one-half of the clear height to the ceiling, whichever is less. Loft guards shall not have openings from the walking surface to the required guard height that allow passage of a sphere 4 inches (102 mm) in diameter.*

SECTION Q109—LOCATION, MAINTENANCE AND IDENTIFICATION

Q109.1 Maintenance. *Emergency housing and emergency housing facilities shall be maintained in a safe and sanitary condition, and free from vermin, vectors and other matter of an infectious or contagious nature. The grounds within emergency housing sites shall be kept clean and free from accumulation of debris, filth, garbage and deleterious matter. Emergency housing and emergency housing facilities shall not be occupied if a substandard condition exists, as determined by the enforcing agency.*

Q109.1.1 Fire hazards. *Dangerous materials or materials that create a fire hazard, as determined by the enforcing agency, shall not be allowed on the grounds within emergency housing sites.*

Q109.2 Identification. *Emergency housing shall be designated by address numbers, letters or other suitable means of identification. The identification shall be in a conspicuous location facing the street or driveway fronting the building or structure. Each identification character shall be not less than 4 inches (102 mm) in height and not less than 0.5 inch (12.7 mm) in width, installed/painted on a contrasting background.*

SECTION Q110—EMERGENCY HOUSING FACILITIES

Q110.1 Drinking water. *Potable drinking water shall be provided for all occupants of emergency housing.*

Q110.2 Kitchens. *Where occupants of dependent units are permitted or required to cook for themselves, a separate area shall be equipped and maintained as a common use kitchen. Refrigerated storage shall be provided for safe storage of food.*

Q110.3 Toilet and bathing facilities. *When dependent units are used as emergency housing, the emergency housing site shall be provided with one toilet and one bathing facility for every 15 occupants of each gender. The enforcing agency may permit different types and ratios of toilet and bathing facilities. The approval shall be based upon a finding that the type and ratio of toilet and bathing facilities are sufficient to process the anticipated volume of sewage and waste water, while maintaining sanitary conditions for the occupants of the emergency housing.*

Bathing facilities shall be provided with heating equipment which shall be capable of maintaining a temperature of 70 degrees F (21.0 degrees Celsius) within such facilities.

Lavatories with running water shall be installed and maintained in the toilet facilities or adjacent to the toilet facilities.

Q110.4 Garbage, waste and rubbish disposal. *All garbage, kitchen waste and rubbish shall be deposited in approved covered receptacles, which shall be emptied when filled and the contents shall be disposed of in a sanitary manner acceptable to the enforcing agency.*

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HISTORY NOTE APPENDIX

2025 California Building Code
California Code of Regulations, Title 24, Part 2 Volume 2

HISTORY:

For prior code history, see the History Note Appendix to the *California Building Code,* 2022 Triennial Edition, effective January 1, 2023.

1. (BSC 05/24, DSA-SS 05/24, DSA-AC 01/24, HCD 05/24, HCD 1-AC 01/24, SFM 04/24, DCA 01/24, OSHPD 04/24 and OSHPD 05/24)—Adoption by reference of the 2024 *International Building Code* with necessary amendments to become the 2025 *California Building Code*, and repeal of the 2021 edition of the *International Building Code*. Approved by the California Building Standards Commission on February 26, 2025, filed with Secretary of State on March 7, 2025, and effective on January 1, 2026.
2. Erratum to address miscellaneous corrections in Matrix Adoption Tables and throughout Chapters 16, 16A, 17, 17A, 19, 19A, 21, 21A, 22, 22A, 23, 24, 30, 31, 33, 35, Appendices D, H and J, effective January 1, 2026.

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